COMMERCIAL IN CONFIDENCE

Evaluation of Functional Performance in Commercial Buildings

Report No. 2001-011-C

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Research Program C:
Delivery and management of built assets

Project 2001-011-C
Evaluation of functional performance in commercial buildings

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1. PREFACE

This final report on research project 2001-011-C *Evaluation of Functional Performance in Commercial Buildings* is the culmination of considerable input from the project's industry and academic partners. Particular acknowledgement is required for the efforts of the Queensland Department of Public Works (QDPW), ARUP and Rider Hunt Terotech. QDPW's Keith van Eyk was instrumental in getting this project off the ground, while Mervyn Cowley, Teng Hee Tan and Craig Pearmain have made significant inputs and, at a senior level, Don Allan and Selwyn Clarke have been very supportive. Emlyn Keane and David Donnan from ARUP and Stephen Ballesty and Nick Ferrara at Rider Hunt Terotech have also played an important part in the success of the project.

There has been academic input from John MacFarlane of the University of Western Sydney while the major research components have been undertaken by the Research Associates, initially Janine Irons and thereafter the team of Philip Kimmet, Marcello Tonelli and Andrew Wong. Mervyn Cowley has not only been an active industry member but also a key researcher as a CRC CI Scholar.

Central to this project has been the analysis of four (4) case studies of CBD commercial office buildings owned and operated by the QDPW, and largely occupied by other State Government Departments. The buildings were inspected by the project's industry partners, ARUP and Rider Hunt Terotech, and extensive reports have been furnished with the express purpose of determining annual operating and capital cost projections. A further report has been compiled by Dr David Parker reviewing appropriate software applications. These reports are important attachments hereto.

There are a number of projects underway in the CRC for Construction Innovation that link to components of this project. Much of the perceived overlap pertains to the triple bottom line component. For instance, research project 2002-043-B, *Smart Building for Healthy and Sustainable Workplaces* deals with similar issues, but aims to assess technologies that can promote healthy and sustainable workplaces. By comparison, the project reported here is focussed on the evaluation, measuring and monitoring of the workplaces themselves, with a view to maximising value. The findings of research project 2001-005-B *Indoor Environments: Design, Productivity and Health* are also helpful because they demonstrate the link between productivity and wellbeing, and air quality in particular. Finally, research project 2001-006-B *Environmental Assessment Systems for Commercial Buildings* shares some of this project's objectives while concentrating on the design phase of construction with the development of a practical 3D CAD model labelled LCADesign. As such, project 2001-006-B is very much the 'front end' of the tool kit for assessing the environmental impact of commercial buildings. This project should therefore be seen as complimentary in that it provides an ongoing management tool that takes over where LCADesign finishes up.

This opportunity is also taken to thank the helpful administrative staff at Construction Innovation and the research committee for supporting the project and to acknowledge the assistance of the program director Professor Tony Sidwell.

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2. EXECUTIVE SUMMARY

This report fully summarises a project designed to enhance commercial real estate performance within both operational and investment contexts through the development of a model aimed at supporting improved decision-making. The model is based on a risk adjusted discounted cash flow, providing a valuable toolkit for building managers, owners, and potential investors for evaluating individual building performance in terms of financial, social and environmental criteria over the complete life-cycle of the asset.

The 'triple bottom line' approach to the evaluation of commercial property has much significance for the administrators of public property portfolios in particular. It also has applications more generally for the wider real estate industry given that the advent of 'green' construction requires new methods for evaluating both new and existing building stocks.

The research is unique in that it focuses on the accuracy of the input variables required for the model. These key variables were largely determined by market-based research and an extensive literature review, and have been fine-tuned with extensive testing. In essence, the project has considered probability-based risk analysis techniques that required market-based assessment.

The projections listed in the partner engineers' building audit reports of the four case study buildings were fed into the property evaluation model developed by the research team. The results are strongly consistent with previously existing, less robust evaluation techniques. And importantly, this model pioneers an approach for taking full account of the triple bottom line, establishing a benchmark for related research to follow.

The project's industry partners expressed a high degree of satisfaction with the project outcomes at a recent demonstration seminar. The project in its existing form has not been geared towards commercial applications but it is anticipated that QDPW and other industry partners will benefit greatly by using this tool for the performance evaluation of property assets.

The project met the objectives of the original proposal as well as all the specified milestones. The project has been completed within budget and on time.

This research project has achieved the objective by establishing research foci on the model structure, the key input variable identification, the drivers of the relevant property markets, the determinants of the key variables (Research Engine no.1), the examination of risk measurement, the incorporation of risk simulation exercises (Research Engine no.2), the importance of both environmental and social factors and, finally the impact of the triple bottom line measures on the asset (Research Engine no. 3).

3. EVALUATION OF FUNCTIONAL PERFORMANCE IN COMMERCIAL BUILDINGS

3.1 Introduction and Objectives

3.1.1 Research Goals and Objectives

The overall goal of the project was to provide a tool for improved investment decision making for functional performance of investment property. The evaluation examines both ex post and ex ante building performance within operational and investment contexts and considers the resultant financial, environmental and social impacts.

The objective of this project was to develop a forward-looking property performance evaluation model that was both structurally accurate and easy to use, and incorporate the following features:

1. A cash flow based study assessing the functional performance of investment property assets.
2. An instructional tool that identifies the key input variables and provides guidance on the selection of the key variables.
3. Produce outputs in a probabilistic format that identifies the range of uncertainty in the output figures and incorporates an assessment of risk.
4. The identification of the environmental and social factors that form part of the evaluation process and the establishment of the triple bottom line evaluation format.

Development and testing of the model included the collection and application of extensive historical income and expense data for four sample CBD office buildings built in four different decades and owned by the Department of Public Works. Details of these case study buildings are summarised on the following pages. This portfolio offered a unique opportunity to study fully occupied and operational buildings with design and construction styles from different eras.

Inspections of the buildings by a team of engineers from Rider Hunt Terotech and ARUP were programmed to generate detailed capital and operating expenditure projections for the buildings. The objective of the collection and input of this factual building data was the realistic comparison of the model derived values and return measures with those independently assessed.

The end product of the research focussed on delivering the model, in software form, and a user manual in a form suitable for use by the industry partners.

3.1.2 Partner needs

The Queensland Department of Public Works, a major commercial property owner with a portfolio valued at over $1 Billion, had an in-house requirement and industry need for enhanced office building cash flow modelling techniques to provide support mechanisms to underpin and optimise property ownership and management decision making. This need was also substantiated by the project's independent study of the cash flow models adopted by major Melbourne and Sydney property institutions (Parker, 2003).

Other project partners, including Rider Hunt Terotech and ARUP, are specialists in building condition assessments and scheduling projected capital and operating expenses. These partners assisted with linkage of physical and investment performance measures in the model and help to assess the property value and return impacts of future building

expenditure decisions. An objective was the development of a useful tool for the property industry. Regular workshops throughout the project were required to inform the industry partners on advances made and on the methodology and information sources being fed into the model to allow it to function as reliably as is possible.

3.2 Project Progress

3.2.1 Commencement

Development and testing of the model included the collection and application of extensive historical income and expense data for four sample CBD office buildings built in four different decades and owned by the Department of Public Works. Details of these case study buildings are summarised in Table 3.1. This portfolio offered a unique opportunity to study fully occupied and operational buildings with design and construction styles from different eras.

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Table 3.1 Case study buildings

Building: 111 GEORGE STREET **Address:** 111 George Street, Brisbane City			
Property Description A modern, A-Grade, 30 level office building completed in 1994, comprising two levels of basement car parking, a lower plaza level (conference facilities), ground level and 26 upper levels of office accommodation.			
Physical Details		**Financial Details**	
Site Area	2,541m²	**Value** (31/12/02)	$103,000,000
Total Net Let. Area	27,402m²	**Value Rate $/m² NLA**	$3,759
Retail Component	0.0017%	**Office Rent $/m²**	$350
Car Spaces	117	**Park. Rent / bay pcm**	$325
Parking Ratio	1 space per 234m²	**Est. Net Ann. Income**	$8,020,485
Typical Floor Plate	998-1068m²	**Capitalisation Rate**	7.75%
Build Date	1994	**Est. Outgoings $/m²**	$78

Building: EDUCATION HOUSE **Address:** 30 Mary Street, Brisbane City			
Property Description A semi-modern, B-Grade, 27 level commercial office building completed in 1986 and including three basement levels of parking, a lower ground plaza level incorporating parking and retail tenancies, ground level foyer and auditorium and 22 upper levels of office accommodation.			
Physical Details		**Financial Details**	
Site Area	3,664m²	**Value** (31/12/02)	$66,000,000
Total Net Let. Area	22,347m²	**Value Rate $/m² NLA**	$2,953
Retail Component	0.0075%	**Office Rent $/m²**	$290
Car Spaces	218	**Park. Rent / bay pcm**	$325
Parking Ratio	1 space per 103m²	**Est. Net Ann. Income**	$5,710,842
Typical Floor Plate	966-1053m²	**Capitalisation Rate**	8.50%
Build Date	1986	**Est. Outgoings $/m²**	$77

Building: MINERAL HOUSE
Address: 41George Street, Brisbane City

Property Description

A semi-modern, B-Grade, 30 level commercial office building completed in 1979 and including three basement levels of parking, ground level retail tenancies, office accommodation and foyer, three upper podium levels and a further 23 tower levels of office accommodation.

Physical Details		Financial Details	
Site Area	2,811m²	**Value** (31/12/02)	$77,000,000
Total Net Let. Area	29,468m²	**Value Rate $/m² NLA**	$2,613
Retail Component	0.0031%	**Office Rent $/m²**	$285
Car Spaces	124	**Park. Rent / bay pcm**	$325
Parking Ratio	1 space per 238m²	**Est. Net Ann. Income**	$6,867,588
Typical Floor Plate	1,065-1,107m²	**Capitalisation Rate**	8.75%
Build Date	1979	**Est. Outgoings $/m²**	$70

Building: PRIMARY INDUSTRIES BUILDING
Address: 62 Ann Street, Brisbane City

Property Description

A semi-modern, B-Grade, 10 level commercial office building completed in 1968 and including a basement level, ground level, three upper podium levels and five upper levels of commercial office accommodation. A major refurbishment occurred in 1989 and the air conditioning plant and lifts have been upgraded in recent years.

Physical Details		Financial Details	
Site Area	2,746m²	**Value** (31/12/02)	$29,000,000
Total Net Let. Area	14,602m²	**Value Rate $/m² NLA**	$1,986
Retail Component	0.0%	**Office Rent $/m²**	$265
Car Spaces	11	**Park. Rent / bay pcm**	$325
Parking Ratio	1 space per 1,327m²	**Est. Net Ann. Income**	$2,751,809
Typical Floor Plate	1,351-1,819m²	**Capitalisation Rate**	9.25%
Build Date	1968	**Est. Outgoings $/m²**	$74

Four research fields were established to breakdown the topic into manageable portions as follows:

(1) Property Market Trends

The literature review in this field was extensive and many complex forecast models of property and rent cycles were examined, with several being tested in the Brisbane market.

Unfortunately none of the models was found to produce reliable results in the local market due mainly to different locational drivers and the inadequacy of the data available. It became obvious that this would be a major task of the project to find a forecasting model for rental growth trends. Because of the inability of existing econometric models to predict the market trends, the project team undertook market surveys and examined the use of system dynamics to provide further explanation of the casual factors influencing market trends.

The outcome of this research field was the specification of the inputs into the model as the key variable inputs. This output was transformed into the process identified as "Research Engine No. 1" and it defined the three key input variables of the model, being the discount rate, the rental growth rate and the terminal capitalisation rate.

(2) Tenant Demand

This study examined the specific demand factors for office building tenants, their ability to pay rent, and their level of satisfaction. After an initial investigation, it was obvious that this was a complex field with little "property tenant demand" literature available. The outcome of the new research project, being Project 2003 - - C, will in time be of benefit to that project as further input into market rent, vacancy factor, and rental growth variables.

(3) Building Condition

The objective of the Building Condition research team was to establish detailed operating and capital expenditure components in relation to varying building ages and condition. Detailed building reports from both ARUP and Rider Hunt Terotech were available to this team and formed the basis for establishing the structuring of projected capital expenditure under the headings of:

- Building fabric and finishes
- Civil, structural and façade engineering
- BCA compliance
- Compliance with the Disability Discrimination Act
- Building services engineering

The forward projections from the audit were included in the model and provided useful information to QDPW on the condition of the four buildings.

(4) Governance

This team examined the appropriate outputs of the cash flow model and the decision support requirements of the performance evaluation. It soon became apparent that the output should be specified in triple bottom line (TBL) terms. This meant that the environmental and social indicators must be identified and measured.

Social/political issues were explored and tested against a case study. The output of this team was the adoption of the environmental grading system of the Green Building Council of Australia (Green Star Environmental Rating System) and a set of social indicators and measures.

The work in this field resulted in the Research Engine No. 3 that provides the triple bottom line performance evaluation component of the model. Because of the exploratory nature of this research field, there is need for further research to establish practical and quantifiable measures for the social indicators.

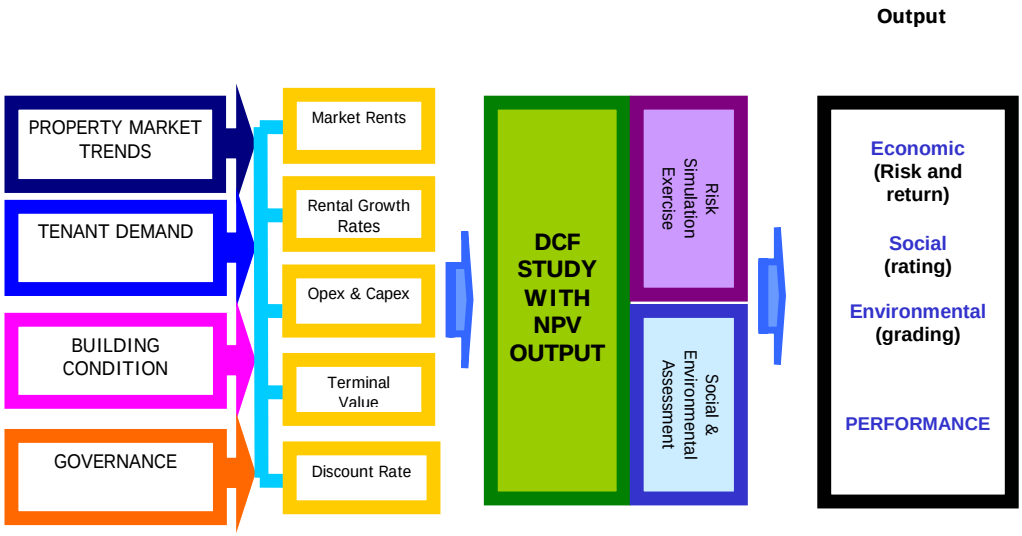
3.3 Model development and industry practices

A cash flow model that was appropriate for commercial building functional performance evaluation was developed. The model had to be both structurally correct and comprehensive so that detailed analysis of the buildings can be undertaken. In addition it should include rigorous risk evaluation.

The outcome was the development of a generic cash flow model that incorporated both sensitivity studies and risk simulation. The simulation process is based on a Crystal Ball ® program with the inputs and interdependency tests analysed within Research Engine No. 2.

The theory behind the model considers the impact of property market, building condition and governance factors on financial variables, such as market rents, building operating costs, as well as variables used to assess property values and investment returns (Figure 3.1). These factors are accounted for in a detailed cash flow study that also includes qualitative inputs on environmental and social criteria.

Figure 3.1 Diagram depicting model theory



3.3.1 Office rent models

Property market modelling and forecasting is the logical progression beyond property cycles research. The Project 2001-11C model, as with all other commercial property evaluation models used by practitioners, relies on the user input of economic, market and individual property performance forecasts as ingredients to derive measures of value and investment return.

A critical component of these forecasts is the projection of rental / income growth for the building being evaluated. Many influences determine rent growth projections, including economic, property market and property specific factors.

The United States has dominated research in the field of rent modelling, but there have also been some contributions from the United Kingdom and Australia. The key to the development of rent models is the identification of the property market, economic and financial determinants driving changes in office rents. Multiple regression analysis is still the dominant method of rent modelling, but more advanced have emerged in recent years.

An extensive literature review found 22 office rent models developed internationally over the last 20 years. Table 3.2 gives a summary of the model structures, explanatory variables, data scope and test results.

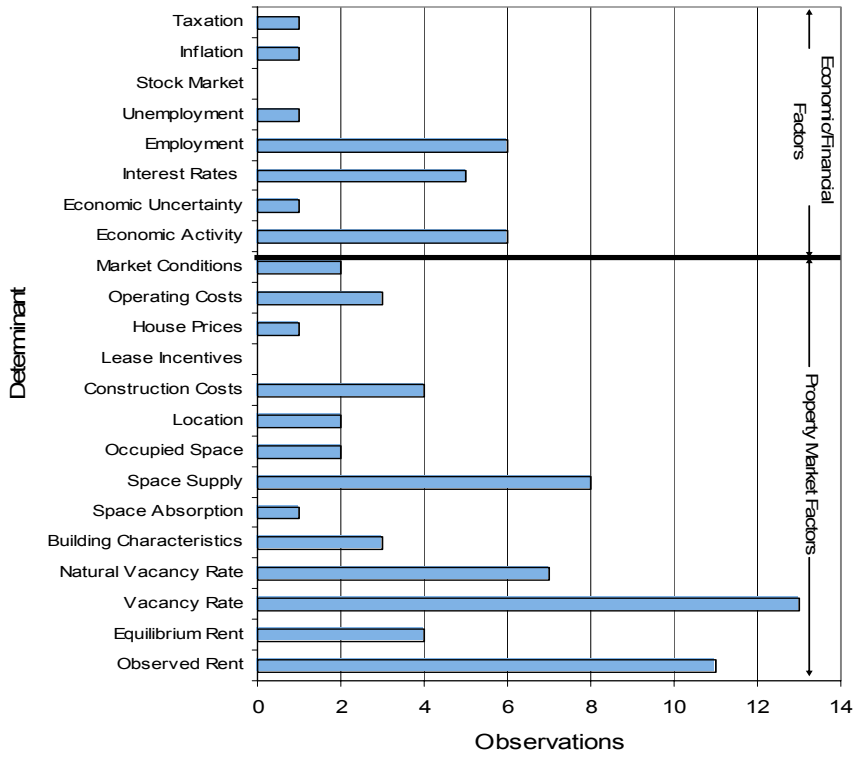
Table 3.2 Office Rent Explanatory Variables Adopted by Researchers

OFFICE RENT MODELS – DETERMINANTS																								
		Property Market Factors															Economic / Financial Factors							
Researcher(s)	Year	Rent	Equilibrium Rent	Vacancy Rate	Natural Vacancy Rate	Building Characteristics	Space Absorption	Space Supply	Occupied Space	Location	Construction Costs	Lease Aspects	House Prices	Operating Costs	Market Conditions	Economic Activity	Economic Uncertainty	Interest Rates	Employment	Unemployment	Stock Market	Inflation	Taxation
Rosen KT	1984	■		■	■				■		■							■				■	■
Hekman JS	1985			■												■			■	■			
Shilling J,Sirman C & Corgel J	1987			■	■									■									
Wheaton WC & Torto RG	1988	■		■	■																		
Frew J & Jud GD	1988			■		■				■													
Gardiner C & Henneberry J	1988							■								■							
Gardiner C & Henneberry J	1991	■														■							
Dobson SM & Goddard JA	1992	■											■					■					
Glascock JL Kim M & Sirmans CF	1993					■				■					■								
Giussani B, Hsia M & Tsolacos S	1993							■							■	■	■		■				
Hendershott PH et al*	1996	■	■	■	■						■			■				■					
DiPasquale D & Wheaton WC	1996	■	■	■			■	■	■										■				
Hendershott PH	1997	■	■	■	■																		
Dunse N & Jones C	1998	■				■					■												
D'Arcy E et al	1999							■								■			■				
Hendershott PH et al	1999	■	■	■	■						■			■				■					
Wheaton WC	1999							■											■				
Chaplin R	2000	■						■								■							
Murray J	2000			■				■															
MacFarlane J et al	2002			■														■					
Hendershott PH et al	2002	■		■				■											■				
Tse RYC & Fischer D	2003			■	■																		
Observations		11	4	13	7	3	1	8	2	2	4	0	1	3	2	6	1	5	6	1	0	1	1

Reproduced from Cowley, 2004.

Figure 3.2 displays the relative dominance of the explanatory variables adopted by the researchers.

Figure 3.2 Dominant Office Rent Explanatory Variables Adopted by Researchers



Reproduced from Cowley, 2004.

This representation clearly shows the reliance on vacancy rate and the "spread" between it and the "natural" or "equilibrium" vacancy rate as indicators for changes in office rents. The focus on vacancy rate as a rent determinant has increased during recent years and it was also the dominant explanatory variable adopted in early office market modelling during the mid 1980s. To a certain extent, the concept of the rent driving "adjustment path" between observed and "equilibrium" vacancy rates has displaced the use of economic variables such as Gross Domestic Product. Recent studies, such as Tse and Fischer, substantiate arguments that "equilibrium" vacancy rates vary spatially and over time (Tse and Fischer (2003).

Additionally, a significant number the models developed over time include a lagged or an observed rent variable as an element for determining rental change. New space supply has also frequently been incorporated in models as an influence on rent levels.

The dominant economic indicators adopted in rent modelling over time have been economic activity (usually represented by Gross Domestic Product), interest rates and office-based employment. While the office workforce has been adopted as an indicator in several models, there has not been a decisive treatment of how office space per worker varies over time.

Rent determinant research has established the importance of office space supply, particularly in terms of its impact on vacancy rates, as a driver for changes in office rent levels. Hence, the capacity to forecast the supply of office space entering the leasing market has significance for forecasting rents.

Past building booms were seen as being generated by a convergence of strong space demand, a shortage of space supply and reduced financing constraints (Barras, 1994). Studies distinguished building cycles as extending from nine to twelve years in the US (Wheaton, 1987). Frequently a consistent view surfaced concerning the unique lag periods attaching to office development and the inelasticity of supply as compared to space demand (Gallagher & Wood, 1999). This, together with the propensity for the development industry to oversupply the office market was seen as major contributors to the volatility of commercial property market. The concept of irreversible investment was raised in this context as a scenario specifically related to property development where once a project is underway it is difficult to withdraw from a development without substantial losses (Kummerow, 1997).

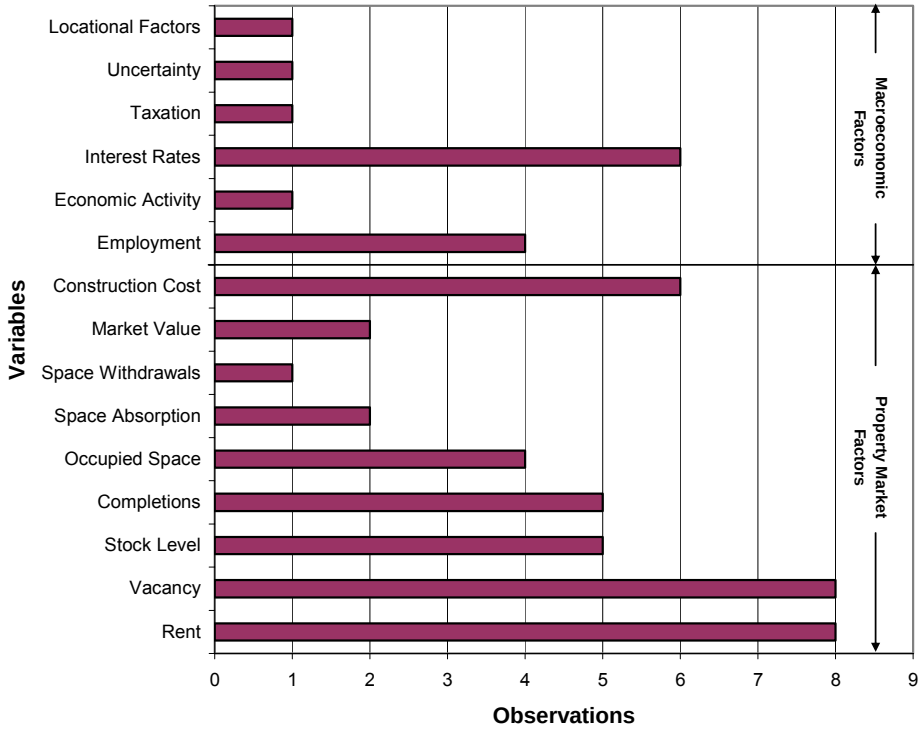
In sum, office space supply has been modelled since the early 1980s, with a wide spread of determinants adopted to explain changes in office construction. Rent, vacancy rates, lagged completions and construction costs are the most represented property market variables, while employment and interest rates appear as the dominant macroeconomic variables (Table 3.3 and Figure 3.3).

Table 3.3 Office Space Supply Explanatory Variables Adopted by Researchers

Researcher / Year	Rent	Vacancy	Stock Level	Completions	Occupied Space	Space Absorption	Space Withdrawal	Market Value	Construction Cost	Employment	Economic Activity	Interest Rates	Taxation	Uncertainty	Locational Factors
Rosen (1984)	■	■						■	■	■		■	■		
Hekman (1985)	■								■	■		■			
Wheaton (1987)	■	■	■	■	■				■	■		■			
Gardiner & Henneberry (1988)			■	■	■										
Hendershott, Lizieri & Matysiak (1996)	■	■													
DiPasquale & Wheaton (1996)		■	■	■	■	■									
Wheaton, Torto & Evans (1997)	■	■							■			■			
Viezer (1999)			■		■			■	■						
Tsolacos & McGough (1999)	■										■			■	
Sivitanidou & Sivitanides (2000)	■			■					■	■		■			■
MacFarlane & Moon (2000)		■	■												
MacFarlane et al (2002)	■	■					■								
Tse & Webb (2003)		■		■		■						■			
Observations	8	8	4	5	4	2	1	2	6	4	1	6	1	1	1

Reproduced from Cowley, 2004.

Figure 3.3 Dominant Space Supply Explanatory Variables Adopted by Researchers



Reproduced from Cowley, 2004.

3.3.2 Evaluating sustainability

Current approaches to construction innovation concentrate on sustainable development principles that cater for environmental sensitivities. There is significantly less effort aimed at improving the human aspects of building management practices, or attempting to understand how design and functional performance impacts certain practices and policies. Such an approach would emphasise the social imperative of development, but has received comparatively little attention from researchers concerned with optimising productivity and asset value in the built environment. There has been some interest in 'green' construction guidelines that admittedly have broader social implications, but these generally have little to say about already existing buildings, slowing down change significantly.

Further complicating the social building agenda is the idea that social responsibility is an administrative concept rather than a demonstrative model, and the kind of outcomes it produces are accountability, transparency, social justice and even generosity and philanthropy (Kimmet, 2003). Industry legislators and relevant self-governing bodies have failed to realise that transforming commercial buildings into socially responsible entities is not a prohibitively expensive thing to do. International research indicates that the construction premium for 'green buildings' are quickly recouped in energy and maintenance savings. Meanwhile, benefits in terms of productivity and health are significantly undersold (Kats et.al, 2003).

In sum, with the notable exception of a handful of examples such as Sydney's 5 star ABGRS rated Bovis Lend Lease Building, *30 The Bond*[1], the first 5 star office building, William McCormack Place in Cairns built by the QDPW, and perhaps to a lesser extent the

[1] *30 is not just the street address, but also stands for 30% less CO_2 emissions*

Melbourne City Council administrative building and Brisbane's *William Buck Building*[2], current industry practice fundamentally fails to convey the importance of intrinsically human considerations over competing, often economically-based, and on occasions politically charged considerations. As a result there has been little dilution of the 'short-term profit' approach to decision-making, meaning that on the whole, socially sustainable buildings are yet to become a prime deliverable of developers and managers who wish to embrace an equitable basis to both construction and administration. And this hesitancy by the industry to supply a changing market translates into evaluation practices that are also beginning to appear outdated.

3.4 Literature review

3.4.1 Property Cycles

It is well understood that property cycles exist, and that Property returns and values move up and down over time. The Royal Institution of Chartered Surveyors (RICS, 1994) defines property cycles as:

> "*…recurrent but irregular fluctuations in the rate of all-property total return, which are also apparent in many other indicators of property activity, but with varying leads and lags against the all-property cycle.*"

This imperfect nature of the property market offers opportunities for prosperous investments, but also has the capacity to cause financial distress and ruin. Sykes estimates the aggregate write-offs and provisionings by Australian lenders during the 1991 to 1994 property downturn was $28 Billion (Sykes, 1996). Kummerow (1997) suggests that much of this could be attributed to non-performing real estate at the time. He also argues that Australian office oversupply was a major contributor to the severity of the early 1990s recession.

The better our understanding of property market cycles and drivers, and the impacts of the entire range of economic variables and other linkages, the more prudent our real estate decisions, particularly in relation to investment timings. This assertion foreshadows the need for property market forecasts as the next research step beyond cycles analysis. After all, market forecasts are an industry-accepted component of the value and investment return assessment processes for commercial property. And recent surveys of the property industry confirm this, finding that the majority of Australian property investment institutions relied on DCF analyses to assess the performance of their portfolios (Parker, 2003; Cowley, 2004). However, these surveys also found that the testing of the forecasts' accuracies was carried out on an unclear and informal basis.

Multiple studies in the United States have confirmed the existence of property cycles and have identified and quantified linkages with micro and macro economic factors. Such linkages include building rents and values adjusting to the nature of economic climate and the level of employment growth affecting the supply and demand aspects of the property market. And levels of vacancies are often cited as important indicators of rent and building cycles.

Several proponents have produced research which confirms regional centres have inherent variations to their property cycle profiles and market volatilities, and should be investigated and analysed on an individual basis. Researchers have also identified construction lags, interest rate fluctuations and property price growth surpassing inflation as generators of the documented building over-supply situations in many countries. Analysis has found investors over-value property assets during the peaks of property cycles and, conversely, under-value assets during cycle troughs. Human behavioural aspects, such as simple optimism and

[2] *Brisbane's flagship 'green' high-rise office building has a 4½ star ABGRS rating.*

pessimism, are considered to influence property cycles, as well as a "herd" mentality that appears to afflict investors.
Many property cycle researchers have undertaken correlation analyses to determine whether correlations exist between property market variables and a wide range of international, national and regional economic parameters. The dominant property market aspects used in testing includes:

- Building rents;
- Regional / centre building vacancies;
- Property income and capital returns;
- Property values;
- Construction activity and development approvals;
- Construction costs;
- Building space absorption; and
- Property yields / capitalisation rates.

The dominant economic parameters tested in the analyses are:

- Employment growth;
- Inflation;
- National and regional economic activity (GDP);
- Interest rates;
- Share market activity;
- Alternative investment returns;
- Capital availability; and
- Foreign investment.

Studies have been successful in establishing and quantifying a number of linkages between property market and economic factors. Several studies progressed further to provide estimates of the lead and lag times that have existed between the turning points of numerous property market variables and economic indicators.

Over time, property cycles research has derived very strong views about the necessity of incorporating cyclical allowances for property variables, such as rents, capitalisation rates and property operating expenses, in discounted cash flow analyses produced for property assessments. And tests demonstrate that the application of over-simplified, linear and compounding growth projections in DCFs can have adverse affects on analysis results.

International research has also identified the recent influence of globalisation, particularly financial markets deregulation, on the profile of property cycles. This finding emphasises the need to include a wider scope of international factors in local property assessments.

Much of the Australian research has followed US and UK studies. Practical studies of the Sydney and Melbourne property markets have concluded property cycles have produced significant impacts on the success, or otherwise, of property developments and investments. A recurring theme has been the absolute necessity to account for the cyclical aspects of property and market variables in DCF analyses. This has proven to be particularly relevant for development projects with long lead times during which market factors such as rental and vacancy levels can change significantly.

Australian research has also confirmed that forecasts produced for the property market should not be based simply on the profile of historical trends. As is the case for international research, linkages have been found between economic factors and property cycles. This has prompted calls for these linkages to be incorporated in property market / DCF forecasts.

The evolution of the property cycles literature is shown in Table 3.4.

Table 3.4 Evolution of Property Cycles Research – Summary

Year	Researcher(s)	Subject	Summary

1987	Wheaton	US office market cycles	▪ Analysed national US office construction and vacancy data to derive 12 year recurring cycle ▪ Linkages found between changes in office employment and building supply and demand variables
1988	Wheaton & Torto	Vacancy rates and office rents	▪ Determined office vacancy rate as a key explanatory variable for rents and building cycles ▪ Severity of boom / bust cycle attributed to developers lagging optimum timing by building too late in booms
1988	Voith & Crone	US office vacancy rates and market shocks	▪ Market cycles and "natural" vacancy rates found to vary in different US metropolitan areas
1990a	Pyhrr, Born & Webb	Investment strategies accounting for inflation scenarios	▪ Analysis found building rents and operating expenses "highly" correlated with inflation ▪ Presented different investment strategies to deal with different inflation scenarios
1990b	Pyhrr, Born & Webb	Explicit incorporation of cycles in property assessment model	▪ Development of model accounting for property demand and supply cycles; inflation rate cycles; property life cycles; and ownership life cycles ▪ Four cycle types said to impact on property net returns ▪ Introduction of "equilibrium rent" concept
1994	Born & Pyhrr	Impact of cycles on property valuations	▪ Argued for cyclical market and economic forecasts rather than trend forecasts being included in property assessments ▪ Case study comparing trend and cyclical valuation models found significant variations
1995	McGough & Tsolacos	Forecasting UK office rents using ARIMA models	▪ Correlation analysis found pro-cyclicality between rents and demand side variables such as office employment
1995	Su & Kelly	Study of cycles in European property markets	▪ Five part correlation analysis undertaken testing for relationships between selected property market and economic variables in 12 Western European cities ▪ Found cycles difficult to detect in cities except London
1996	Roulac	Differentiating property market cycles, transformation forces and structural change from trends	▪ Discussed necessity to take account of higher order changes in property markets in assessing cycles ▪ Changes in employment, construction methods, information and communication technology and company structures given as examples
1997	Kaiser	Long cycles in real estate	▪ constructed long-term US commercial property data series in order to investigate the existence of "long cycles" in real estate ▪ found real estate boom / bust events preceded by periods of above-average inflation (peaking every 50 to 60 years) ▪ considered "long cycles" more relevant for assessing property portfolio weightings
1999	Pyhrr, Roulac & Born	Implications of real estate cycles for investors and portfolio managers	▪ categorised seven major cycle types and 44 component cycles ▪ basic principles for tracking, comprehending and acting on real estate cycles given, including focusing on cycles with greatest impacts on rents, vacancies, capitalisation rates and values
1999	Wheaton	Real estate cycle fundamentals	▪ demonstrated different property types were subject to different cycle influences ▪ found certain combinations of parameters produced instable responses to economic shocks

			while others did not
1999	Grissom & DeLisle	Real estate cycles and structural change	▪ examined property cycle stages with the aim of modelling the impact exogenous shocks that caused structural change in the market ▪ determined it was possible to track key exogenous shocks signalling that structural change had occurred in the markets
2000	Dehesh & Pugh	Globalisation and property cycles	▪ found deregulation of capital markets played a part in increasing the volatility of property cycles
2002	Mueller	Future property cycles	▪ considered future cycles would be more moderate due to "more rational" capital markets led by better information, monitoring and feedback systems
2003	Pyhrr, Born, Manning & Roulac	Cycles framework and classification	▪ developed common terminology; theoretical framework; and methodology for cycles research

Two frameworks developed by American researchers are of particular note in relation to the model developed by Project 2001-11C. The first, published by Born and Pyhrr (1994) as a *Cycle Model Framework and Linkages*, provides an appreciation of the impacts of the property market and economic cycles on the valuation / return assessment for an individual commercial property. The second framework published by Pyhrr, Born, Manning and Roulac (2003) as the *Real Estate Cycles Research Framework and Classification Model*, is the culmination of many years research by prominent real estate researchers and provides detail on the complicated intricacies involved in forecasting property performance. Both of these frameworks are represented in Figure 3.4 and Figure 3.5.

Figure 3.4 Cycle Model Framework and Linkages – Reproduced from Born and Pyhrr (1994)

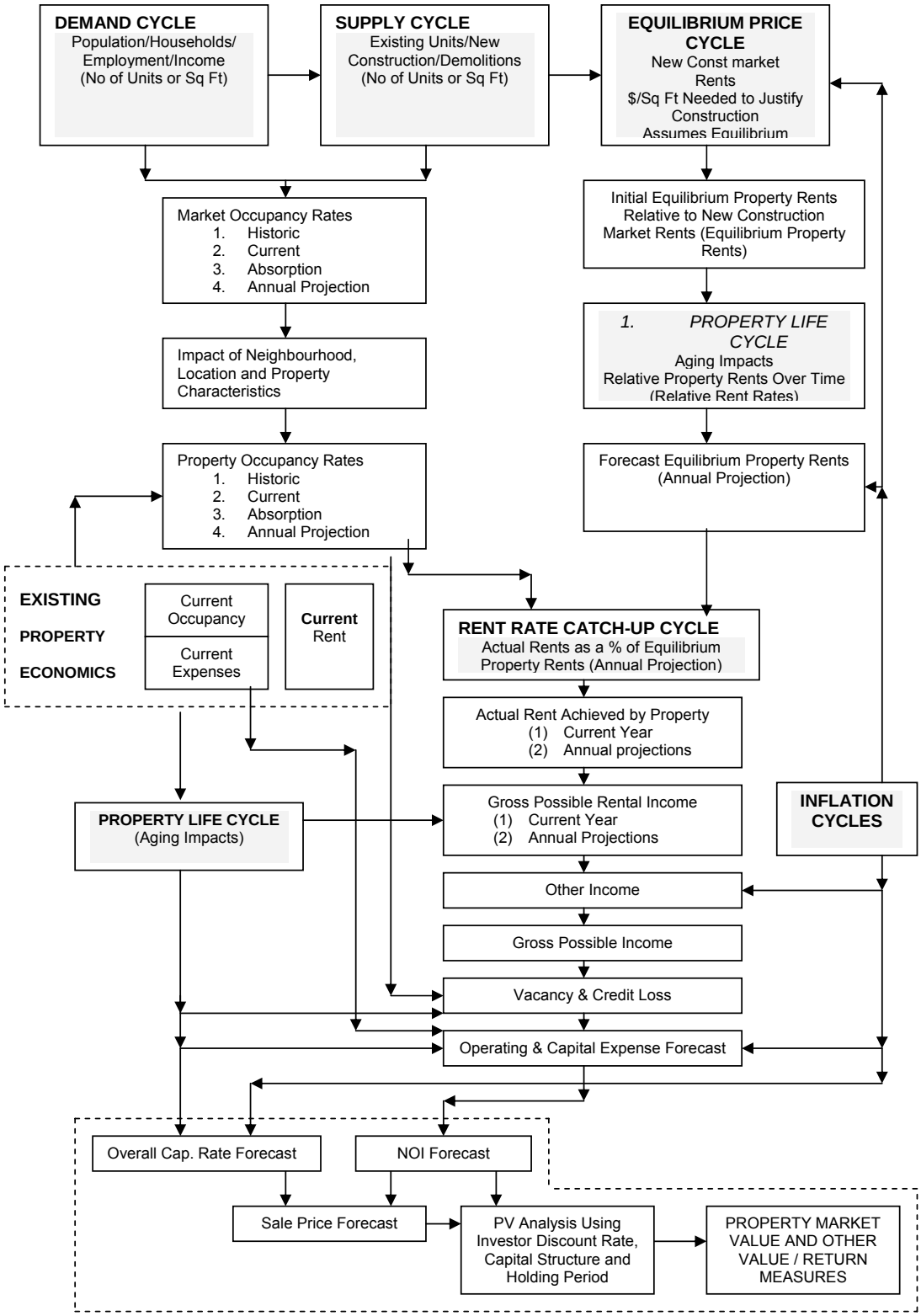
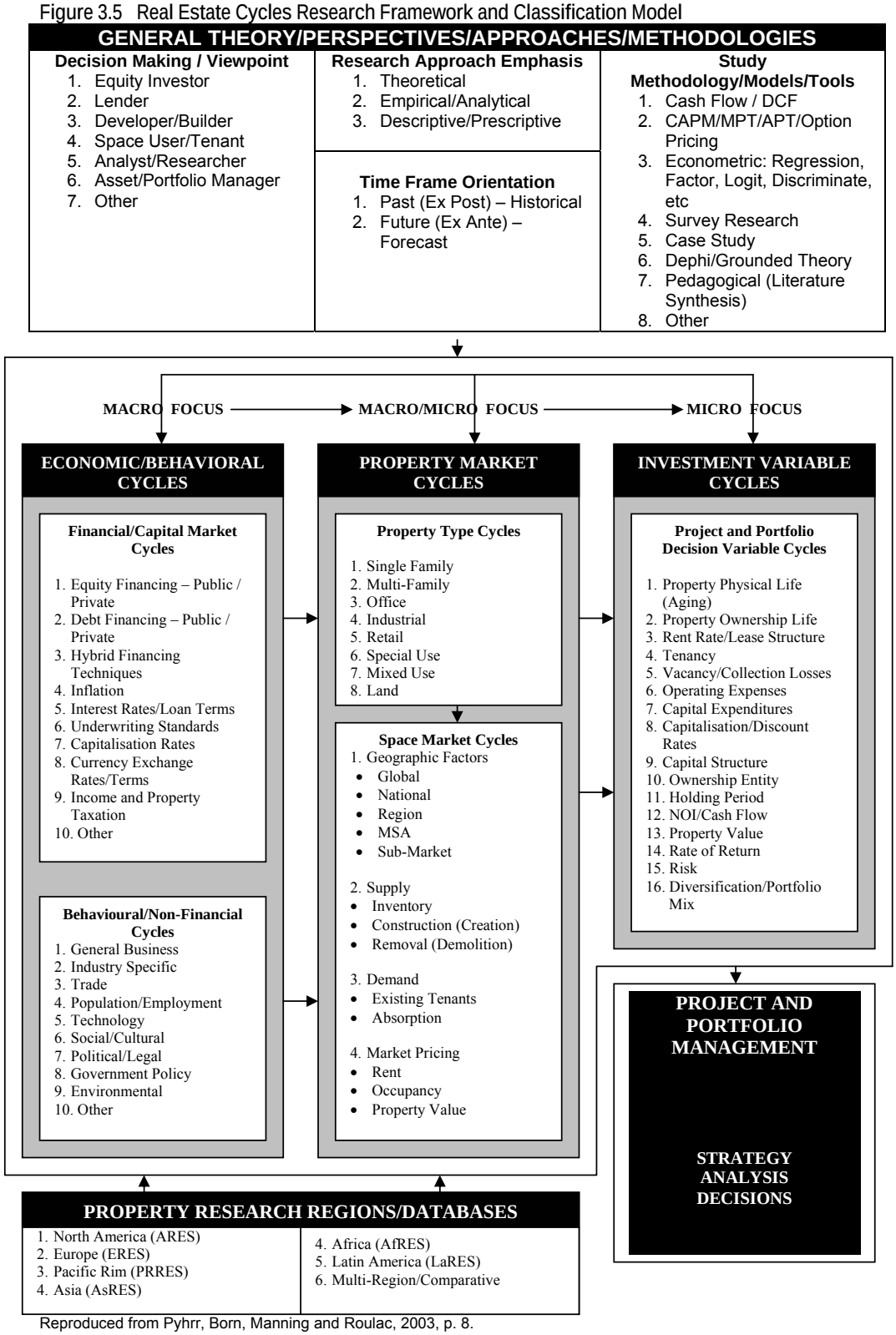


Figure 3.5 Real Estate Cycles Research Framework and Classification Model



Reproduced from Pyhrr, Born, Manning and Roulac, 2003, p. 8.

Property market cycle research in the Australian context has been limited and has not evolved to the extent as it has in the United States and the United Kingdom. Recognition

dawned in Australia in the mid-1980s that the process of valuing and analysing real estate projects required increased explicitness in dealing with market risks. The inappropriateness of simply applying historical evidence to determine the end values of projects was identified, together with a necessity to investigate projected supply and demand factors. The adoption of discounted cash flow (DCF) analysis was promoted in lieu of the use of the all assumption implicit capitalisation method of valuation. The concepts of sensitivity, scenario and risk analysis also came to light (Squirrel, 1985).

By the early 1990s, analysts had identified the increased market risks flowing from the often long development periods required for large commercial construction projects. The potential for rental rates and the level of building vacancies to alter dramatically during the construction of office towers was recognised and documented (Ragan, 1993).

During the mid-1990s, the difficulty of valuing commercial properties in circumstances where there was a lack of recent and relevant sales evidence was raised. This increased the focus on DCF analysis and the validity of property cash flow variables forecasts (Parker, 1994).

Arguments also surfaced against the application of simple linear growth projections in DCF analyses in favour of cyclical forecasts for cash flow variables. The concepts of long-term equilibrium values, rents and vacancy rates were also put forward as indicators for determining the directions of property cycles (Kummerow, 1995).

Newell and Higgins (1996) argued that the linkages between the property market and economic factors through correlation analyses determined such factors should be included in the formulation of property market predictive models.

Meanwhile, Higgins (1999) investigated commercial real estate cycles in the Australian context using 40 years of construction data for the office, retail and industrial sectors as a proxy for real estate performance to analyse the cycle elements, due to limited historical property data. Initially, the usefulness of construction data as a proxy was confirmed by a correlation analysis with Property Council of Australia real estate return data. The raw construction data was adjusted for the influence of “one off developments”, seasonal variations and inflation. A four point moving average was adopted, and measurements were taken of the timing of troughs and peaks as well as wavelengths, amplitudes and angles of the cycles.

A “multiplicative decomposition” method was also applied to segregate the time series into trend, seasonal, cyclical and irregular (random) components. The decomposition process provided no evidence of regular cycles over time and between the measured time series. This was said to highlight the irregular nature of the Australian commercial property market over the last 40 years. On this basis, Higgins concluded that it was of limited value to forecast the future performance of real estate markets founded solely on historical market cycles.

3.4.2 Triple bottom line

Attaching social responsibility to building functional performance is a very recent idea, although the notion of social investment dates back to the 17th century Quakers. More than a century later, governments began to embrace social investment with the advent of the ‘age of reform’. In more recent times, corporations have been forced into rethinking the notion of social responsibility as a result of the shareholder activism inspired by Ralph Nader, and the increasingly powerful environmental movement that gained momentum with Rachel Carson’s publication of *Silent Spring* in 1962.

The starting point for all contemporary research dealing with sustainability however is the World Commission on Environment and Development’s *Brundtland Report*, also known as *Our Common Future* (WCED, 1997). This benchmark report distilled thinking about sustainable development into a definition that has framed all subsequent research. It

declared that sustainable development was about meeting "the needs of the present without compromising the ability of future generations to meet their own needs". More importantly as far as social responsibility is concerned, the report also urged environmental policymaking to become more practical and to harmonise economic and environmental agendas.

The idea that business has a major role to play in this agenda has its origins in the World Business Council for Sustainable Development's submission to the Earth Summit in Rio de Janeiro in 1992, and which found support in the UN *Agenda 21* Declaration. Their submission outlined how progress toward sustainable development makes good business sense, arguing that it can actually create competitive advantages and new opportunities. The submission pointed out that this requires a fundamental shift in corporate attitudes by acknowledging the entire life cycles of products. Essentially, the Council was advocating a shift from viewing the environment as, at best, a necessary cost, to understanding that the environment also offers opportunities and profits. They also pointed out that there was a weakness in financial accounting systems that increasingly failed to record key aspects of a company's true capital such as reputation, social capital and environmental risk.

The submission by the Business Council for Sustainable Development foreshadowed the broadening of the environmental debate by embracing the notion of social responsibility and underscoring the need to include a third bottom line of accountability and social goal setting. More than a decade later though, the property industry appears to be lagging behind the industrial and resources sectors when it comes to embracing these ideas, although there are many publications that deal with social responsibility as an investment strategy. Most of these however fail to mention the potential of social responsibility in real estate. Exceptions that do briefly discuss it, and also emphasise how much of this area is yet to be explored, is Mansley's (2000) *Socially Responsible Investment: A guide for pension funds and institutional investors*, and Sparkes (1995) *The Ethical Investor: How to make money work for society and the environment as well as for yourself*. And perhaps the most well known advocate of socially responsible investment, Amy Domini, who has released a string of publications on the subject, has made some lofty claims about the emerging practice. For instance, in an early co-authored work she states that "socially responsible investing is political; it is intended to achieve social and political ends. And it is succeeding." (Kinder et al, 1993).

Nathan Engstrom has mapped out how sustainability principles have progressively become more important in the built environment in his paper 'The Rise of Environmental Awareness in American Architecture: From the Bruntland Commission to LEED' (Engstrom, 2002). The paper also emphasises the increasing role of indicators in measuring and reporting the sustainability of buildings. The work of the United States Green Building Council (USGBC) in establishing *LEED* (the Leadership in Energy and Environmental Design Green Building Rating System) should not be undervalued in this push for objective benchmarking. Likewise, the corporate initiatives of the Foundation for the Built Environment in the United Kingdom, which developed *BREEAM* (Building Research Establishment Environmental Assessment Method), and the work of SEDA and their Australian Building Greenhouse Rating System (*ABGRS*), have been instrumental in promoting ecological concerns in the built environment. However, these rating schemes, and even more recent systems such as the Green Building Council of Australia's *Green Star*, and the Australian Government's *NABERS*, all tend to focus on the environmental component of the triple bottom line (Sayce and Ellison, 2003).

The proliferation of environmental rating schemes has occurred without a great deal of intellectual rigour in the form of reliance on an established body of literature exploring appropriate indicators for buildings. It is not surprising therefore those somewhat belated studies such as the *Sustainable Property Appraisal Project* underway at Kingston University in the UK, and indeed the project being summarised here, are finding that a building's social criteria are not being adequately evaluated by these systems. It would be wise at this juncture therefore to take a step back and examine some closely related literatures that may cast more light on the best way to proceed with sustainable property indicators.

One rapidly expanding literature supporting the 'environmental value' approach to sustainability of buildings is what has been coined 'natural capitalism' – a term borrowed from Hawken et al (1999), notwithstanding a large preceding body of research on resource efficiency and cleaner production (Greenfield and Hundloe, 2000). These authors make the insightful remark that appraisers 'rarely credit efficient buildings for their energy savings'. This means that "the value of the efficiency cannot be capitalized, making financing and valuation more difficult" (Hawken et al, 1999). They suggest that valuers are actually beginning to be left behind by the market, arguing that "a more transparent and accurate market is starting to recognize that buildings' energy efficiency is an important constituent of their financial value". So from this literature we learn that glossing over the ecological footprint of buildings actually disguises its true value in human and environmental terms.

There is also a recognised body of work that focuses on the design phase potential of the triple bottom line approach. McDonough and Braungart (2002, p.153) point out that the triple bottom line of ecology, equity and economy is borrowed from the tripod symbology of conventional design criteria: cost, aesthetics, performance. They argue that while the triple bottom line has had a positive effect in terms of sustainability, in practice "social or ecological benefits [tend to be] considered as an afterthought rather than given equal weight at the outset…In other words, they (businesses) assess their health as they always have – economically – and then tack on bonus points for eco-efficiency, reduced accidents or product liabilities, jobs created, and philanthropy". McDonough and Braungart conclude that businesses that don't commence from a triple bottom line platform, and instead attempt to tack it on at the end, "are missing a rich opportunity…to create value in all three sectors".

Scepticism that views triple bottom line reporting as a band-aid approach to the ills of short-term economic gain and short-sighted decision making is also evident in the environmental accounting literature. Deegan (1999) for instance asserts that while triple bottom line approaches are reformist, they are really only an extension of traditional accounting practice that favours the restriction of corporate disclosures to issues related to economic performance. And more forcefully, Everett and Neu (2000) argue that environmental accounting focuses on win-win, technocratic and procedural solutions to problems created by slavish devotion to capital accumulation. From this point of view environmental accounting and triple bottom line approaches reinforce the dominating discourse that assures us that progress is being made with social and environmental solutions, while distracting us from asking the difficult questions regarding the perpetuation of unequal and exploitative social relations. Their argument positions sustainable development and the triple bottom line as business opportunities to expand into emerging markets, ostensibly demonstrate social responsibility, and most certainly assist survival in an increasingly competitive corporate climate. Such motivations clearly encourage the 'greenwashing' of business activities, with the implication for the evaluation of property being that social and environmental benchmarks need to be rigorously designed and tested, and full disclosure of information is imperative.

And finally there is a diverse and expansive theoretical literature that underpins ideas about why the triple bottom line impacts the market. However, this need not be discussed here as this has been covered at some length in a paper written as part of this project and presented at the PRRES conference held in Bangkok in January 2004. The paper, 'An Institutional Understanding of Triple Bottom Line Evaluations and the use of Social and Environmental Metrics', is attached in Appendix IV.

3.5 Project Deliverables

3.5.1 The Cash Flow Model

Model objectives

The project model has been designed to satisfy a number of objectives, including:

- User guided value assessment tool for office buildings;
- Decision support tool for property owners through demonstrating the valuation / investment return impacts of tenancy, operating expenditure and capital expenditure decisions;
- Provision of guidance on forecasting and selection of key model variables including rent growth rates, inflation, terminal capitalisation rates and discount rates;
- Graphical representation of a building's performance in terms of industry operating expense benchmarks;
- Incorporation of an innovative, professionally developed capital expenditure projection format;
- Clear account of lessee incentive and letting up allowances over the life of the cash flow study;
- Presentation of clear linkages between office building physical and financial performance;
- Consolidated scheduling of monthly and annual income, outgoings and net cash flow projections for the term of the cash flow study;
- Graphical output comparing forecast: gross and net income; market and lease rents; and operating and capital expenditure;
- Sensitivity analyses generated through Crystal Ball® software using Monte Carlo simulation processes; and
- Built-in rent forecasting module to provide guidance on rent growth for the Brisbane CBD.

These objectives have been achieved, with the model generating realistic valuations by comparison with conventional independent property assessments. This discussion is tabulated in Table 3.5.

Table 3.5 Structure and content of the software cash flow model

Component	Purpose	Inputs / Outputs
① Key Assumptions	Sets parameters for assigning and forecasting market and economic variables.	• Property holding period • Market derived discount rate • Terminal capitalisation rate • Financing parameters • Inflation forecast • Rent (office, retail, car park and other) forecasts • Building vacancy and bad debt allowances • Lease incentive and letting up allowances
② Lease Schedule	Schedules building commercial lease details.	• Lessee names and locations within building • Lease floor areas • Annual rents • Car park allocations and rents • Commencement, expiry dates and lease terms • Rent review mechanism details
③ Income Schedule	Forecasts market rent for each tenancy sourcing data from the assumption and lease schedules. Forecasts lease rents, accounting for rent reviews and lease expiries, sourcing data from the market rent schedule.	• Monthly market rent forecast for each tenancy over cash flow horizon • Monthly rent escalation percentage for office and retail space and car parks • Monthly lease rents over cash flow horizon for office and retail space and car parks
④ Operating Expense Schedule	Lists one year forecast of statutory and non-statutory building operating expenses and compares them with industry benchmarks.	• Listing of individual statutory charges and operating expenses • Calculation of rates per square metre per annum for each expense • Listing of PCA benchmarks for each expense and graphical comparison with actual building expenses
⑤ Capital Expenditure Schedule	Professionally developed building capital expenditure projections over cash flow horizon.	• Tabulated projections of annual expenditure on ▪ Building fabric and finishes; ▪ Civil, structural and façade engineering; ▪ Building Code of Australia compliance items; ▪ Compliance with Disability Discrimination Act; and ▪ Building services engineering. • Graphical representation of categorised annual capital expenditure projections
⑥ Lease Incentives and Letting Up Allowances	Monthly projections of leasing inducements and agents' commissions for space vacancies over cash flow horizon.	• Lease incentives and letting up allowances for individual tenancies based on assumptions sourced from assumption sheet
⑦ Discounted Cash Flow Analysis (Monthly)	Consolidated forecast of monthly building income and expense data over the cash flow horizon to derive net cash flow. Future net monthly cash flow is discounted back at the specified discount rate (assumption schedule) to calculate a present value.	• Monthly building gross income projections sourced from income schedule including: ▪ Retail rent; ▪ Commercial rent; ▪ Naming rights fees; ▪ Communication carrier income; and ▪ Storage rent. • Monthly building expense projections sourced from expense schedules including: ▪ Operating expenditure; ▪ Bad debt and vacancy allowances; ▪ Incentives; ▪ Agents commissions; and ▪ Capital expenditure

⑧Discounted Cash Flow Analysis	Consolidation of monthly DCF schedule to annual income, expense and net cash flow figures.	• Same figures (as above) for monthly DCF analysis presented in annual form.
⑨Property Council of Australia Operating Costs Benchmarks	Tabulated summary of operating costs benchmarks for Brisbane CBD buildings of three size ranges and two building grade ranges.	• Serves as an automated output to the operating expense sheet, allowing the subject building's operating costs to be benchmarked against industry averages sourced from a substantial sample of Brisbane CBD buildings
⑩Charts	Illustrative charts linked to the cash flow study showing the buildings projected performance based on the assumptions adopted in the model.	• Output charts including: ▪ Total gross income / net cash flow comparison; ▪ Forecast building rent / market rent comparison; ▪ Forecasting operating expenditure; and ▪ Sensitivity analysis – variations in terminal capitalisation rate and discount rate
⑪Guide to Forecasting and Variable Selection	Qualitative and quantitative advice on forecasting rent, terminal yield and inflation rates and selecting discount rates.	• Property professional sourced determinants of terminal capitalisation rates and quantitative ranges of current rates for the Brisbane CBD • Sources of inflation rate forecasts and a graphical representation of historical rates for the Brisbane CBD • Property professional sourced determinants of discount rates and a quantitative range of current rates for the Brisbane CBD • Guidance on the formulation of rent forecasts including an equation estimated for the Brisbane CBD
⑫Rent Forecasting Model	Statistical regression tool to generate a five year rental rate forecast for the Brisbane CBD subject to some user inputs.	• Calculation tool for estimating rent forecasts based on the results generated by the equation described in sheet ⑪
⑬Sensitivity / Simulation Analysis	Detailed key variable sensitivity / simulation (Monte Carlo) analysis run via Crystal Ball software	• Generates charts and detailed statistical analyses on the results of fluctuations in key variables such as rent growth rates, discount rates and terminal capitalisation rates.

Key forecast variables

The key forecast variables were identified and tested for their property valuation impacts through the application of sensitivity analyses using the project model. Analyses were undertaken for each of the four sample buildings using actual income and operating expense data. The four key variables identified included: discount rates; terminal capitalisation rates; inflation forecasts; and rent forecasts. Each variable was adjusted independently by percentage increases and decreases above and below market sourced rates and ten year forecasts. Figures 3.6 to 3.9 display the relative valuation changes through adjusting each of the variables.

Figure 3.6 Value Sensitivity – Discount Rates

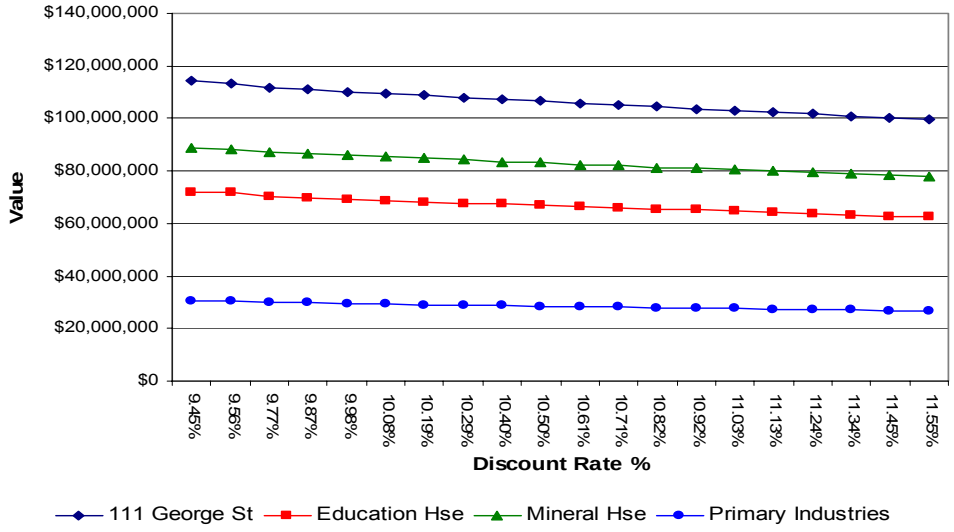


Figure 3.7 Value Sensitivity – Terminal Capitalisation Rate

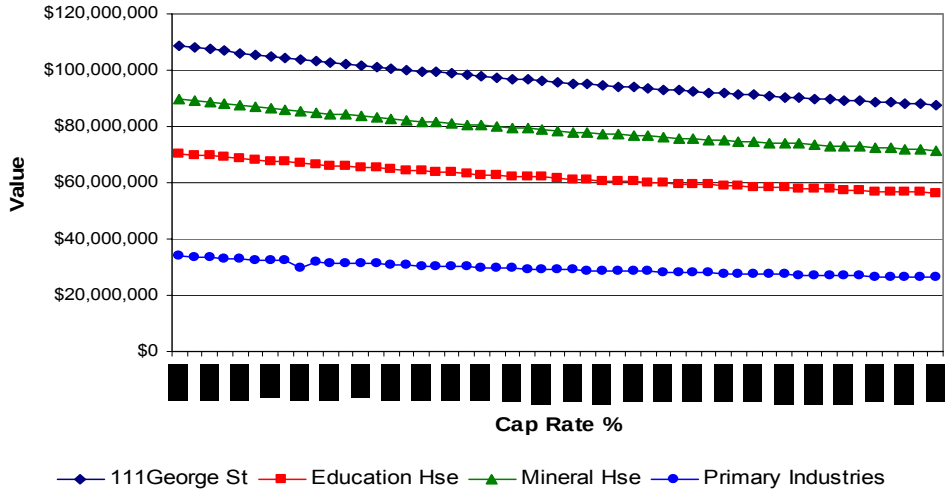


Figure 3.8 Value Sensitivity – Inflation Forecasts

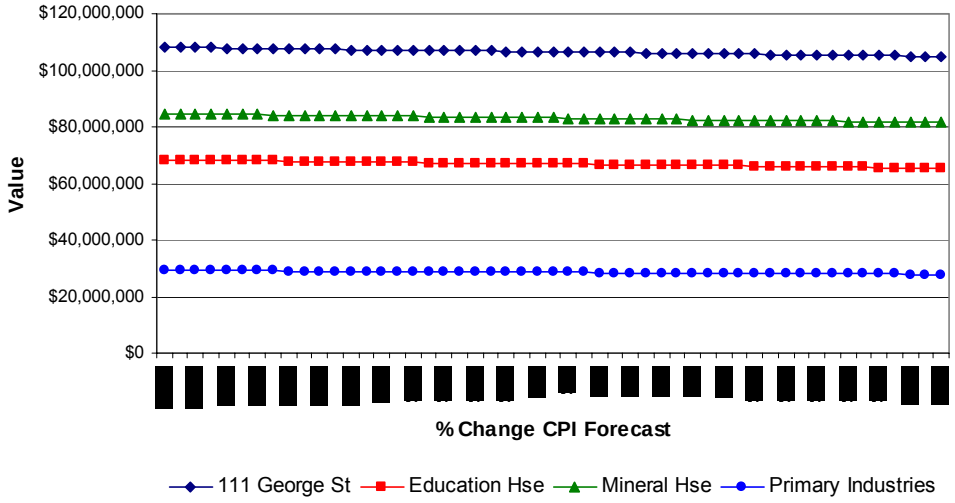
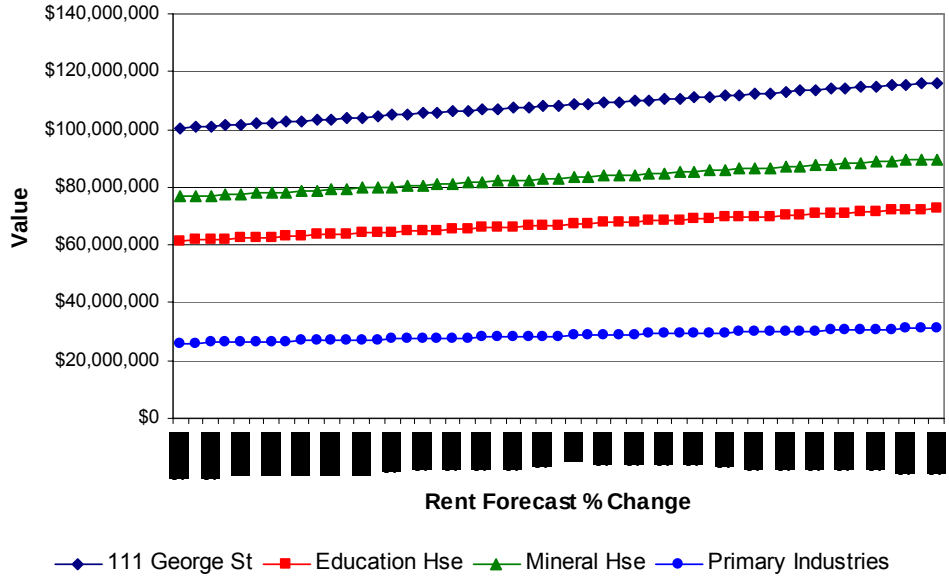


Figure 3.9 Value Sensitivity – Rent Forecasts



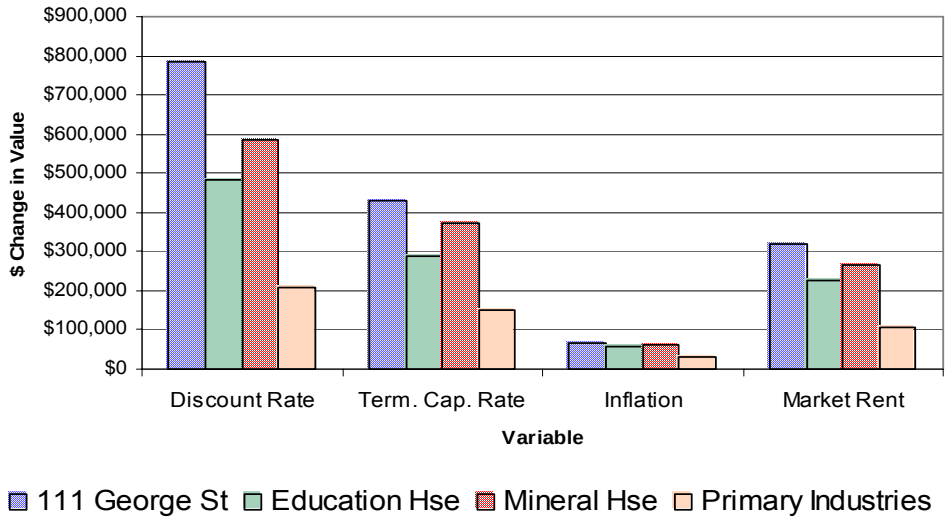
A tabulation of the average building value changes resulting from independent percentile adjustments of each of the four variables is shown in Table 3.6.

Table 3.6 DCF Variable Adjustments Impacts of Sample Building Valuations

Building	111 George St	Education House	Mineral House	Primary Industries
$ Value Change				
Discount Rate	$784,211	$484,211	$584,211	$210,526
Term. Cap. Rate	$430,000	$288,000	$372,000	$150,000
Inflation	$66,000	$58,000	$64,000	$32,000
Market Rent	$318,000	$228,000	$268,000	$106,000
% Value Change				
Discount Rate	0.74%	0.72%	0.70%	0.74%
Term. Cap. Rate	0.40%	0.43%	0.45%	0.53%
Inflation	0.06%	0.09%	0.08%	0.11%
Market Rent	0.30%	0.34%	0.32%	0.37%

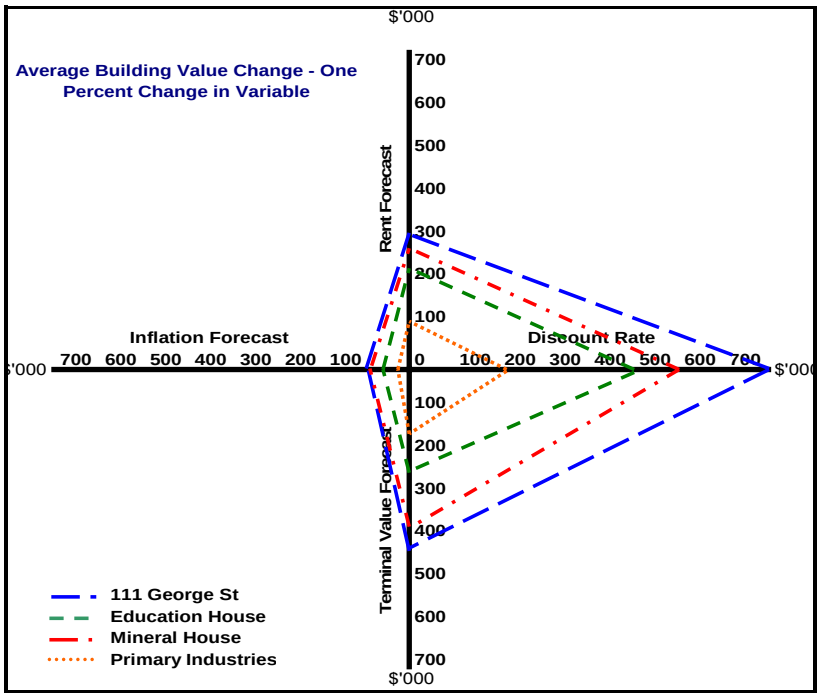
For further comparative clarity, the valuation impacts are represented in the Figure 3.10.

Figure 3.10 Building Value Sensitivity - % Change in Forecast Variables



The spider diagram (Figure 3.11) illustrates this relationship in another format.

Figure 3.11 Average Building Value Change with One Percent Change in Four Key Variables



The analysis indicates, of the four variables, the selection of the discount rate has the most significant impact on the value assessed by the model. The forecast terminal capitalisation rate and forecast market rent cycles follow in importance, while the inflation forecast has the

least impact. Guidance for the selection and forecasting of these variables is provided in the model and the attached instruction manual.

Rental growth forecast

The project model incorporates an office rent forecasting equation estimated for the Brisbane CBD office market. This section provides some background on the development and statistical testing of this model component.

An extensive literature review and data correlation analyses indicated the potential office rent determinants, in the context of the Brisbane CBD, include measures for vacancy rate, new space supply, net space absorption and interest rates. Many of the published models (identified in Section 3.3.1) include the lagged rent despite some questions as to whether this could be considered an independent variable. Chaplin (2000) advocated including the lagged dependent variable to account for any momentum in the series. After some experimentation to determine the optimum lag periods for each of these explanatory variables in the presence of the other variables, the following equation was derived:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 V_{t-2} + \beta_3 SU_{t-2} + \beta_4 AB_t + \beta_5 I_t + \varepsilon$$

Where:

R	Prime gross effective office rent rate
V	Vacancy rate as a percentage of total stock
SU	New office supply as percentage of total stock
AB	Net office space absorption in square metres
I	Commonwealth ten year bond rate as an annual average

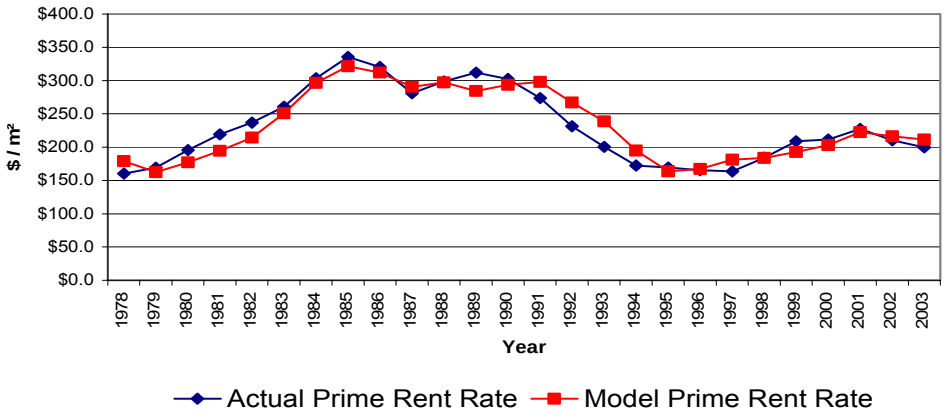
Using annual data covering the period from 1976 to 2003, the equation generated the following results:

Descriptor	Coefficient	t-statistic
β_0	127.778	4.592
β_1	0.533	6.088
β_2	-710.200	-4.792
β_3	30.792	0.298
β_4	0.0002	2.413
β_5	354.087	3.044
Adjusted R^2 = 0.93		Durbin-Watson = 1.97

The results indicate the lagged measures for the rent rate, vacancy and the expected bond rate are significant at a 99 percent confidence level while the anticipated net absorption, as a indicator of demand, is significant at a 95 percent confidence level. The vacancy coefficient is signed as expected, recognising the counter-cyclical relationship between rent and vacancy rates. Surprisingly, the lagged new supply of office space is not significant. A test of an alternative equation incorporating space absorption as percentage of new supply, as a measure of the balance between supply and demand, also failed to enhance its explanatory power.

The overall explanatory power of the equation, as signified by the coefficient of determination (0.93), registers as quite strong. The Durbin-Watson statistic (1.97) signals little autocorrelation remaining in the residuals. Figure 3.12 shows the historical observed rent rates against the forecast rates derived from the equation.

Figure 3.12 Comparison of Actual and Model Generated Historical Rent Rate

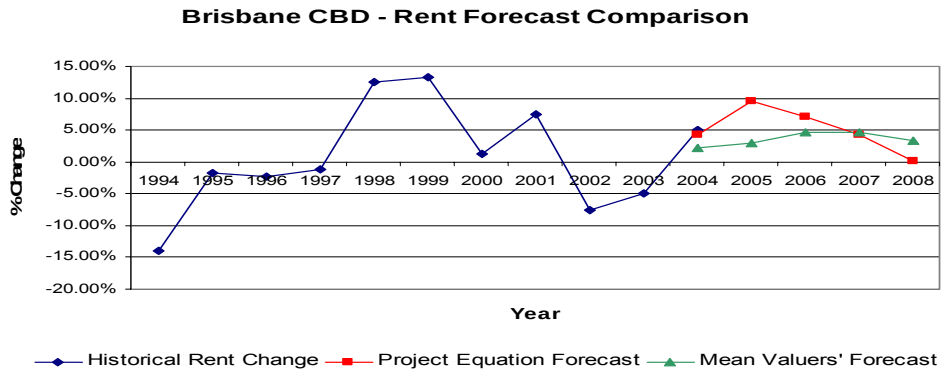


As would be expected, looking purely at the historical context, the equation generated forecasts track the actual historical rent rate movements quite closely. The Theil's U-statistic (0.60) calculated for the forecast rates indicates the equation is superior in forecasting prime rent rates than a "naïve" same change or no change forecast.

These results are qualified, however, due to out-of-sample testing indicating the equation may over-predict rent levels. Many researchers (including Chaplin 2000 and McDonald 2002) have noted the need for qualitative and descriptive forecasting input beyond the scope of pure mathematical models. This has been driven by a perception that the historical fit of rent models may not be representative of their "future fit".

The survey of Brisbane CBD valuers (2004) undertaken is association with this project sourced their views on prime, gross, effective rental growth for the city over the next five years. This is compared with the forecast generated by the rent equation using external forecast estimates for the determinants (Figure 3.13).

Figure 3.13 Prime Effective Gross Rent Forecasts – Survey of Valuers and Project Equation



The equation generated forecast is more volatile than the valuers' forecast, but better represents the historically cyclical nature of the market.

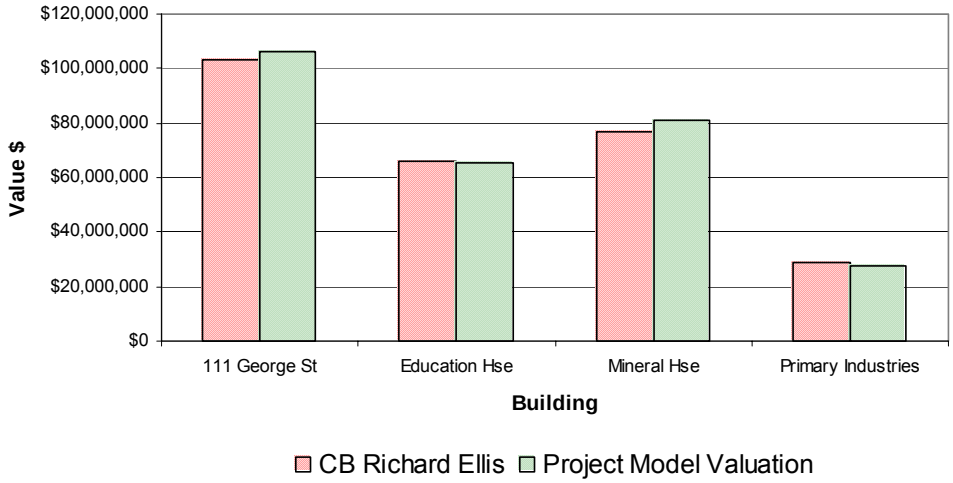
Model Performance

A comparison of the valuation output of the project model was compared with independent valuations prepared by CB Richard Elllis to provide an indication of the model's accuracy. For the purposes of the comparison, the inflation forecast from a firm of economists and the mean rent forecast from the valuers' survey were adopted in the model. The results of the comparison are given in Table 3.7 and Figure 3.14.

Table 3.7 Comparison of Independent Building Valuations and Project Model Generated Valuations

Building	CB Richard Ellis Valuation	Project Model Assessment	% Variation
111 George Street	$103,000,000	$106,500,000	+3.4%
Education House	$66,000,000	$65,500,000	-0.8%
Mineral House	$77,000,000	$81,250,000	+5.5%
Primary Industries	$29,000,000	$27,500,000	-5.2%

Figure 3.14 Comparison – Building Valuations – Model Generated and Independent Valuers



These results demonstrate the project model is delivering realistic assessments in line with market expectations. They also confirm that the "mechanics" of the model operate reliably.

3.5.2 Integrating sustainability

Environmental benchmarks

Valuable work identifying appropriate environmental indicators for built assets has already been undertaken both in Australia and overseas. The Green Building Council of Australia has been very active in this area. The Council's office rating tool has been particularly instructive for developing indicators to measure this project's case study commercial high-rise office buildings. The tool focuses on strategies to enhance efficiency and reduce greenhouse gas emissions, but there is much that translates into the performance assessment context also. However, environmental rating schemes on the whole tend to focus on the design, construction and management rather than looking at buildings as operating entities within a broader market framework in the manner that appraisers do. So the few studies that approach environmental benchmarking from an appraisal perspective are worth closely reviewing here.

The RICS Foundation report (Upstream, 2003) lists energy use, water use, waste management, transport; pollution; and materials use and selection, as the most prominent environmental criteria for appraisers. There is little dispute over the validity of these criteria, although others have further expanded the list. For instance, a project underway at Kingston University in the UK and supported by government and business partners, also includes management or as they call it, occupier criteria. Known as The Sustainable Property Appraisal Project, this project prefers to label water consumption and waste management – ecology, while materials use and selection is subsumed by building flexibility, and design categories. Sayce and Ellison (2003) also identify that indicators in each criterion vary in their impact with respect to environmental, social and economic components. For instance they argue that the indicator 'build quality' has environmental and social impacts only, while 'reuse of building', 'quality of management', and some transport and energy efficiency indicators are exclusively environmental and economic in nature.

Sayce and Ellison list reuse of building; operational CO_2 emissions; embodied CO_2 emissions; CFC emissions; methane emissions; nitrous oxide emissions; hydrofluorocarbon emissions; perfluorocarbon emissions; efficient use of equipment; distance from local public transport nodes; provision of facilities for non-drivers; policies to encourage alternatives to single occupancy car journeys to work; use of brown field sites; quality of management; water consumption; and waste management as distinctly environmental indicators. Let's look at these indicators in a bit more detail.

According to Sayce and Ellison (2003, p.13), the more a building is reused in a variety of ways by its occupants, the more flexible it proves be, and the more resources and energy invariably spent in total redevelopments is conserved. While office high-rise is seldom used for any other purpose, there is no reason why less desirable and aging offices cannot be converted to apartments or a variety of other uses, or even upgraded to exemplary environmentally sensitive space. See for example Melbourne's 60L project (60L stands for 60% less energy, www.60lgreenbuilding.com/). Also there is no reason why the original materials cannot be re-used in refurbishments, and if the façade is retained, this may also add to heritage values.

Operational and embodied CO_2 emissions (greenhouse gasses) are chosen by Sayce and Ellison to measure the energy efficiency of a building because carbon tax and climate change levies in the UK fails to allow for the use of energy generated from renewable resources such as wind power and photovoltaics. This complicates reporting, reduces energy use to an economic basis, and fails to adequately reward the use of renewable energy supplies. In the Australian context, a more accurate picture of responsible energy use can be ascertained by recording and comparing the net fossil fuel energy use, on an intra-building (sub-metering) and market comparison basis. Energy efficiency is clearly a very important environmental indicator, and features prominently in the calculations of the various environmental building rating schemes such as Green Star. As far as embodied energy is concerned though, Sayce and Ellison (2003, p.16) admit that this indicator "is so far considered to be of very limited or no significance to property worth within the existing building stock."

CFC emissions largely relate to the age and condition of air-conditioning equipment, and the desirable use of ODP, and to a lesser extent, GWP refrigerants (GBCA, 2003, p.19). To be adequately reported, maintenance records must be made available to the appraiser. The various other emissions specified by Sayce and Ellison are generally not released in high enough quantities from office high-rise to warrant individual reporting at this stage. It is perhaps more manageable for the appraiser to follow the example of the GBCA and include them under the greenhouse gas reduction criterion.

Efficient use of equipment is closely related to the social indicator – "level of awareness and training on building/socially responsible facilities", except that it takes an environmental

perspective. And as pointed out with the social equivalent, unless there is widespread awareness of the environmentally sensitive design features of the building, optimal benefits will fail to accrue.

From an environmental perspective, transport indicators focus on the availability and efficiency of public transport. The inference is that if public transport is not close by, is irregular, or fails to service a wide area, then occupants will opt to commute using private means, resulting in further reductions in environmental quality. Public transport is of course not the only solution to regular worker commuting. A raft of strategies should be in place to discourage single occupancy vehicle journeys, and there is no reason why these cannot all be reported under a single indicator. Next to public transport, the GBCA offer the second highest transport credits for the provision of cyclist facilities (GBCA, 2003, p.18).

As office high-rise is nearly always located in highly developed centers, it is seldom erected on 'greenfield' sites. However, it is possible that this may be the case, although it might not be evident to the appraiser, meaning that historical disclosure by management could be necessary. Like the efficient use of equipment, an environmental indicator covering this criterion has a very similar social equivalent.

There are at least three major elements of 'quality of management' – managing risk, facilitating the optimal environmental potential of the building, and ensuring good corporate governance, particularly disclosure. The first two elements are reported elsewhere – risk is distributed throughout all the indicators, and maximizing environmental capabilities has its own indicator. Governance on the other hand is such a major component of both the social and environmental dimensions of buildings that it should be divided into sub-categories. It is suggested that transparency of environmental data, any non-compliance with regulations, the winning of awards, and environmental expenditure of any type should be reported as a governance metric. What cannot be emphasised enough though is the centrality of disclosure with respect to governance. Without quality disclosure an accurate triple bottom line assessment cannot be made (Kimmet, unpublished note).

Water consumption and waste management are issues that are likely to increase in importance over time. While there maybe some equipment installed for these purposes, particularly in more modern buildings and also in regard to cooling tower water consumption, these measures rely largely on good policy and implementation of conscientious practices. Specifically, these indicators reflect recycling, water capture measures, and the disclosure and relative performance of wastewater discharge that reduces flow to the sewer. They also question the nature and impacts associated with any hazardous and non-hazardous waste and effluents, and respective recycling or removal strategies.

The 5 indicators that Sayce and Ellison attribute to both environmental and social dimensions are briefly considered here from the environmental viewpoint. Building age may have environmental significance depending on the materials used, condition, and the technology incorporated in the design features. It is clearly less important than build quality, however it may indicate the possible extent of obsolescence and depreciation in terms of environmental appeal. And location from centres assumes greater importance when vehicles are used to traverse the distance between them and the building.

Finally, corporate environmental engagement should reflect the overall performance of the building against environmental benchmarks. This includes internal quality in terms of worker satisfaction, a crucial environmental measure that arguably deserves individual attention. Indeed, the GBCA (2003, p.18) offer credits for several indoor quality features ranging from ventilation to natural lighting, views, individual thermal control, noise abatement and particularly the absence of indoor air pollutants. External quality should also be addressed specifically in terms of aesthetics and visual blending. This involves a building's celebration, utilization, connection, contribution and appropriation of its street frontage and local precinct.

Recommended environmental indicators are given in Table 3.8. They do not appear in any particular order for weighting purposes, but they are organised into 3 distinct criteria.

Table 3.8 Environmental benchmarks for office high-rise

1.Resource consumption	Net fossil fuel energy use, on an intra-building (sub-metering) and market comparison basis. Efforts to reduce greenhouse gas emissions, particularly from energy use. Office lighting power density and peak energy demand reduction strategies. Evidence of alternative energy supplies from renewable sources or from cogeneration.
	Age and condition of air-conditioning plant, and the desirable use of ODP or GWP refrigerants.
	Water consumption from potable, hygiene and cooling tower uses, recycling and water capture measures, and wastewater reduction of flow to sewer. Evidence of hazardous and non-hazardous waste and effluents recycling or removal strategies.
2.Design	Location from centres, public transport availability and standard of service, together with a suite of strategies to discourage single occupancy vehicle journeys, including cyclist facilities.
	Age of building in terms of obsolescence or depreciation of materials detracting from environmental appeal, re-use or upgrade history or potential, suitability of original materials for refurbishment and façade retention, and the ecological impacts of materials used (can be ascertained by using LCA Design or similar software package).
	Indoor quality measured by ventilation, natural lighting, views, individual thermal control, noise abatement and the absence of indoor air pollutants.
	Quality of overall built environment and site use in relation to aesthetics and visual blending, the building's celebration, utilization, connection, contribution and appropriation of its street frontage and wider precinct.
3.Governance	The maximisation by management of the potential of the environmental design features by conducting awareness programs.
	Disclosure/transparency of environmental data, non-compliance with regulations, awards, and environmental expenditure of any type
	Building's net contribution to green space with some consideration to prior land use.

Social benchmarks

So while environmental benchmarking is well advanced, a corresponding effort with respect to social benchmarking needs to be made to provide for meaningful triple bottom line assessments of built assets (Fiksel, 2001). Upstream (2003) list important social issues in the appraisal process as: investment in the community; local employment; stimulating local economic activity; community engagement; accessibility; health and safety; crime prevention; occupier productivity; and employee/ supplier relations. This list is partially endorsed here, with crime prevention the only issue called into question as a legitimate social criterion for benchmarking. Meanwhile local impacts and cultural issues should also be included as highly significant measures of social sustainability in the built environment. Moreover, local employment and economic activity, investment, and employee/ supplier relations are arguably more conveniently reported within stakeholder relations and community engagement criteria. Each of these observations will be discussed in this section.

Crime prevention is an interesting issue. At this stage though, the profile of crime in the context of Australian high-rise office stocks is not significant, nor is it clear how a prospective benchmark should be measured and what the responsibilities of a commercial property are in this regard. It is felt that this area requires further exploration before it could be recommended as an appropriate appraisal indicator.

Investment in the community is possible as either cash injections or in-kind contributions. It is easily measured, as long as records are kept, and disclosure is made to the appraiser. However, 'investment' takes a rather a narrow, material view of community interest, precluding a wide range of building management policies that can benefit the community. It also fails to recognize the broader community as a legitimate stakeholder in commercial property, which after all relies on social capital infusions for commercial success.

It is important to consider what is actually meant by the level of community engagement of a particular property? The first observation to make is that certain properties, by design and purpose, 'engage' the community much better than others. It is therefore important not to compare dissimilar properties. A second point is the difficulty of distinguishing between properties that actually share many characteristics. Arguably the important distinction to make here is with respect to management.

Accessibility is an important social indicator; however it needs to be more clearly defined; specifically, access for whom, by what, and by which standard? Transport should be a separate indicator, so we can assume accessibility refers to walking and wheelchair access for occupants and visitors, in both the internal (ease of access to public and leased space) and external (proximity to desirable spaces from the building) senses.

Health and safety is also clearly important. This not only refers to adequate provisioning and maintenance of the building and plant, but should also include generous insurance and public liability cover in case of injury from accident or the contraction of illnesses such as legionnaire's disease (legionella). This indicator relies heavily on disclosure by management.

Occupier productivity is undoubtedly a leading social indicator for the assessment of commercial buildings. This encompasses the quality of the indoor environment, which is beginning to be researched quite extensively as we have pointed out earlier. It also involves building age and condition, occupant satisfaction, functionality and psychological and physical well-being.

Perhaps more than any other indicator, stakeholder relations relies heavily on disclosure and transparency from management. Objectivity can be brought to the assessment process by interviewing occupants and visitors. An important element here is the quality and content of negotiations with agents, tenants, contractors and staff. It is a strong indicator of management in general, or as it is increasingly referred to in the modern corporate environment, it is the measure of 'good governance'. This will be qualified by the contextual capacity in which the building operates, including the prevailing regulative environment and the level of accountability expected of the individual premises.

Sayce and Ellison (2003) identify 6 indicators that impact on the social dimension of the triple bottom line, and find that a further 5 have both social and environmental implications. The 6 social indicators they suggest are: protection of heritage buildings; access to local green space; local economic impact; occupier satisfaction; functionality; and impact. Obviously heritage buildings' protection only applies to certain, usually older building stock. However, it is unclear how this might impact on market value. Some properties actually decrease in value if redevelopment potential is restricted. On the other hand, ownership and preservation of a heritage property contributes to the 'national estate', and may accrue significance in terms of reputation and social responsibility. More research will need to be undertaken in this area to ascertain the implications for triple bottom line assessment. In the meantime, age of building and renovation requirements can be considered under productivity and satisfaction.

What is of increasing significance in Australia, given the ongoing public debate about reconciliation and native title, is the appropriate recognition of original indigenous owners. This indicator alone occupies the entire focus of a separate paper produced by this project (Kimmet, 2003). And a further cultural indicator that surfaced when the social indicators

discussed here were recently tested was the art on display, measured as a percentage of total fit out cost.

Sayce and Ellison's final social indicator is more difficult to measure. They explain that:

> "a building's physical presence will inevitably illicit a response from the local stakeholder community…[pointing out that]…what is important is public perception of design…. The difficulty with this measure is that issues of taste and perception change over time and it is almost impossible to predict what aesthetic design quality will be valued in the future. Nonetheless, as the assessment will be done on a recurrent basis, it can be kept under review" (Sayce and Ellison, 2003, p.23).

The rest of their discussion concerning this indicator is well worth citing as well.

> "The importance of design is also dependent upon the impact a building has within its location. This requires consideration of the extent to which a building is appropriate to its environment, reflective of local architectural style, a landmark, denoting an important gateway or entrance for example. Does it create a wind tunnel effect for local pedestrians? A building that blends in with the surrounding area will not be unsustainable; neither will it create any positive local impact from which the investor and/or occupier can benefit. A building that has a strong and negative local impact will be a liability to both occupier and investor, in terms of sustainability."

And:

> "the fabric of the local environment uniquely effects the local community and, an occupier and/or investor that shows scant regard for these stakeholders is simply not demonstrating good CSR" (corporate social responsibility).

Sayce and Ellison's 5 indicators that have social and environmental significance are: building age; distance from town centre; distance from local centre; corporate environmental engagement; and build quality. Once again, when approaching the appraisal from a social point of view, building age mostly relates to occupant productivity and satisfaction, and how the age of the building influences maintenance and refurbishment strategies. Meanwhile, distance from town and local centres are a mix of locational and transport factors. From a social perspective, accessibility, which has already been flagged, is generally more significant than the largely economic implications of positioning in the most prestigious and central locations. Transport on the other hand clearly also has environmental significance and in this case in particular it is important not to duplicate the reporting process.

Sayce and Ellison point out there is a danger of also duplicating reporting by making build quality a distinct indicator on its own, when it clearly influences many of the other benchmarks. They also warn that low quality buildings are likely to impact on the corporate image of owners and occupiers. They explain that:

> "whilst it may not be reasonable to suggest that the very existence of a low quality building within a portfolio will increase investor risk, an absence of evidence of efforts to improve the quality, particularly over the long term, may well have a negative impact. Thus it is not so much the existence of the building but the approach taken by the investor (and occupier) to that building."

Corporate environmental engagement is about the acquisition of socially responsible capital (meaning goodwill and reputation) by embracing environmental criteria. This is an important indicator for social impact studies, but in a triple bottom line framework it is arguably best left to environmental indicators.

Other social indicators that neither Upstream (2003) or Sayce and Ellison (2003) discuss are given in the extensive and widely acclaimed work of the Global Reporting Initiative (http://www.globalreporting.org). Admittedly, their approach focuses on business reporting, but some of the indicators they have developed also make sense in the appraisal context. For instance, credible indicators include: level of awareness and training on building/socially responsible facilities; and provision and monitoring of facilities/amenities (emphasis on equal opportunity), and lobby space from the public's perspective. And indicators that can be identified as broader society impacts include the nature of tenant businesses and naming rights, and appropriate training for security personnel.

A socially productive building and advanced social policies alone do not ensure a high level of awareness of the socially optimum use of the premises. Training and regular updating needs to be provided for the occupants to facilitate this. This is fairly straightforward to report on (assuming adequate disclosure), and can be accurately checked by brief interviews or a survey. And reporting on facilities and amenities provision need not be bound by regulations. This is a very important aspect of social responsibility, so it follows that generous common area allocations are highly desirable.

A simple perusal of the nature of businesses housed within a building will help us gauge the level of social support and services provided by tenants, strongly influencing community impressions of the building's social responsibility. For instance, tobacco and alcohol companies and other unethical businesses will detract from a building's public image, particularly if naming rights are acquired. It is envisaged that as triple bottom line assessments are progressively accepted within the industry and this indicator is specifically embraced, then socially irresponsible businesses will begin to expect to have to pay a premium for rental space to compensate for the negative impact of their business on the premises.

Finally, in some instances certain business and executive government may require an overt security presence. In such cases it is important that security personnel are adequately trained in public relations.

Table 3.9 lists 7 recommended social criteria for office high-rise together with the relevant indicators.

Table 3.9 Social benchmarks for office high-rise

1.Health and Safety	- compliance with H & S regulations and appropriate signage - adequate public liability and service provider insurance - awareness and training of emergency evacuation and accident first aid procedures for all floor wardens - a first aid station accessible to all building users
2.Stakeholder Relations	- monitoring of stakeholder concerns, views and provisions - transparency and disclosure of landlord/tenant contracts and marketing agreements - supportive use and occupation guidelines for tenants - appropriate training for security and public relations personnel
3.Community Engagement	- encouragement of employment of local residents within the building - provision of accessible public facilities (seating, toilets) - promotion of and linkage to local service providers - accessible communication channels with building stakeholders
4.Accessibility	- connections to designated green spaces - proximity to urban spaces (town and local centres, malls,. Etc) - availability and efficiency of public transport - wheelchair access and proximity to childminding facilities
5.Occupier Satisfaction and Productivity	- quality of communal service areas e.g. toilets, kitchen facilities - complementary usage of building (compatible tenants) - occupant productivity in terms of satisfaction and physical wellbeing (how measure?) - smart technology design provisions
6.Cultural Issues	- recognition of indigenous people through allocation of cultural space for display or performance, including the communication of site, building or community history - consideration of gender equity and minority group requirements - preservation of heritage values - value of artwork as % of fitout (5% considered acceptable)
7.Local Impacts	- aesthetic implications (compliance with precinct theme, building scale, etc.) - practical implications (traffic generation, off-street emergency parking and pedestrian management) - nature of tenant businesses and naming rights - community linkages and sponsorship of local neighbourhood activities

Evaluation of social indicators

A social assessment of Education House was undertaken to test the social benchmarks developed. Education House is 1 of the project's 4 case study high-rise office buildings. Representatives from the building's 2 major tenants were asked to complete a survey, while a Senior Property Manager in the Department of Public Works, which owns and manages the building, responded to a more detailed questionnaire developed from the social benchmarks being advanced, and reproduced in Table 3.10.

Table 3.10 Questionnaire based on 2001-011-C social benchmarks

√ - responses by Senior Property Manager in the Dept. of Public Works
x - independent evaluation from physical inspection

Social indicators	**1**	**2**	**3**	**4**	**Management comment**
Does the building comply with Health & Safety regulations and is it appropriately signed throughout?			X	√	Complaints driven
Is there adequate public liability and service provider insurance?					Unsure. To be followed up.
Is there widespread awareness amongst occupants, and further training for all floor wardens regarding emergency evacuation and accident first aid procedures?				√ x	
Is a first aid station accessible to all building users?				√ x	Tenant responsibility
Is there adequate monitoring of stakeholder concerns and views, ie. Regarding amenity/service provisions etc.?			x	√	Minuted monthly meeting. Onsite manager
Is there adequate transparency and disclosure of landlord/tenant contracts and marketing agreements?					n.a.
Is there occupation guidelines for tenants, are these clearly articulated, and does management support these guidelines by appropriate means?				√ x	Tenancy management agreement
Is there appropriate training for security and public relations personnel?			√ x		Meets tenants needs
Is employment of local residents within the building actively encouraged?					n.a
Is there adequate provision of accessible public facilities (seating, toilets etc.)?					n.a. Public actively discouraged
Is there adequate promotion of, and linkage to, local service providers?			X		Q Build on-site Nationwide policy
Is there an effective communication channel with building tenants?				√ x	See question 5. Possible duplication
Is there adequate wheelchair access?				√ x	And disabled
Is the building in close proximity to childminding facilities?					Unsure. Whole of CBD issue.
What is the quality of communal service areas (toilets, kitchen facilities etc.)?		x	√ x		
Is there complementary usage of building (are tenants compatible, do they engage professionally, share a common purpose, or exchange equipment, facilities or services)?			X	√ x	Depts. Of Education and Employment & Training are compatible
Does the building have smart technology design provisions?		√ x	√		Advanced lighting and security. Old lifts and air con.
Is there recognition of indigenous people (traditional custodians of the land) through the allocation of cultural space for display or performance purposes?			X		Had a dance group in the foyer once and has displays occasionally
Is there consideration of gender equity and minority group requirements?				√ x	
Have heritage values been preserved?					n.a.

Is there effective communication of site, building or community history (this is of particularly importance where heritage values have been extinguished)?					n.a.
How do you rate the building's fit with the social built environment (with respect to precinct theme, building scale, etc.)?			√ x		More could be spent on streetscaping
Are there adequate provisions for managing street-front social issues (traffic generation, off-street emergency parking, pedestrian management, smoker congregation etc)?			√ x	√	Rates @ 3½. Policies and strategies in place.
Is the nature of tenant businesses and the building's name perceived to be socially responsible and ethical (gaming, alcohol, tobacco, weapons firms etc, score 1; charities and non-profit social institutions score 4)?				√ x	
Has the building or management established community linkages and sponsorship of local neighbourhood activities?					n.a.

The evaluation report is not reproduced here because it is tangential to the central purpose of determining the relative appropriateness of the benchmarks, and how the necessary data can be collected most efficiently and accurately. On the whole, the questions and benchmarks were found to be measurable, allowing an objective and empirical assessment to be made. As can be seen from the comments column though, some questions do not appear to be applicable to this building largely because it is publicly owned. This suggests that these benchmarks would further benefit from testing against a privately owned building.

Another important element of the evaluation was to determine the difference between responses from occupants compared with management. Importantly, both of the tenant representatives agreed they were able to express their concerns and views regarding building condition most of the time. This however has not translated into action in some instances due to budget constraints. For instance, complaints about poorly performing air conditioning on some floors, and inadequate showering and changing facilities for joggers and cyclists have been lodged on numerous occasions with little result. It was found that while management was aware of these problems and sympathetic to occupants, it was responses over these issues that perhaps invoked the greatest discrepancy in terms of performance assessment. On the whole though, both the tenants' and management's views were confirmed by the independent project evaluation.

A key lesson derived from testing the benchmarks developed by the project on case study buildings is the need for uninhibited stakeholder input. In the case of commercial buildings, stakeholders not only include owners, managers and occupants, but the wider public also has a stake in their operation. By this it is meant that management decisions need to be informed by society norms, habits and values, as well as by economic and utility objectives of the parties directly involved. A major plank of this normative agenda is environmental ethics, but it is by no means the only emerging issue to consider.

The media often helps to reflect these wider social norms. This may be indirectly through the provision of forums, or by direct coverage of events such as protests against certain developments, as has been the case in the past in the urban brownfield context with the early morning demolition of aging landmarks. But while the media can alert us to the changing attitudes of society, it is not an alternative to seeking expert advice on sustainability performance in the various areas earmarked by benchmarking. Such advice, when formally tabled, systematically acted upon, and with results measured, speaks volumes for socially responsible self-reporting, improving the sustainability credentials of a built asset exponentially.

3.5.3 Instruction Manual

See attached Appendix II.

3.5.4 Brochure

A draft brochure was distributed to industry partners at the final seminar presentation of the project. The final product is currently being developed.

3.5.5 Project Papers and Presentations

Articles in Refereed Journals

Boyd. T.P, 2003, 'Model Consistency and Data Specification in Property DCF Studies', *Australian Property Journal*, Nov. pp.553-9.

Articles in Industry Magazines

Boyd, T.P, 2003, 'What will the next buyer pay? The key to investing in property', *Queensland Property and Lifestyle*, 4:Summer, pp. 12 – 15.

Refereed Conference Papers

Boyd, T.P, 2003, Property Cash Flow Studies: Focusing on model consistency and data accuracy, electronic refereed publication and conference paper, Pacific Rim Real Estate Society, January, Australia.

Cowley, M, 2003, Forecasting Trends in the Brisbane Central Business District Office Market, electronic refereed publication and conference paper, Pacific Rim Real Estate Society, January, Australia.

Irons, J.J, & Armitage, L.A, 2003, The Future of Office Property, electronic refereed publication and conference paper, Pacific Rim Real Estate Society, January, Australia.

Kimmet, P. 2003 'Socially Responsible Public Administration and the CBD', refereed paper presented at the Institute of Public Administration Australia conference, Nov., Griffith University, Southbank, Brisbane. Available on the net at: http://www.gu.edu.au/school/gbs/ppp/ipaa/ipaa_papers.htm

Kimmet, P. & Boyd, T., 2004 'An Institutional Understanding of Triple Bottom Line Evaluations and the use of Social and Environmental Metrics', presented at the Pacific Rim Real Estate Society conference, Jan., Bangkok.

Ross, S, 2003, 'The Role of Decision-maker Preferences in Tenancy Selection of CBD Office Accommodation – preliminary literature review', Paper delivered at the PRRES conference , January, Brisbane, Australia.

Tonelli, M., Cowley, M. & Boyd, T., 2004, 'Forecasting Office Building Rental Growth – Using a Dynamic Approach', presented at the Pacific Rim Real Estate Society conference, Jan., Bangkok.

Non-Refereed Conference Papers

Kimmet, P. (2003) 'Socially Responsible Commercial Property Entities and the Allocation of Cultural Space', presented at the IASCP 2nd Pacific Regional Meeting, Sept., Customs House, Brisbane.

Completed work to be presented

Cowley, M., 'Forecasting Property Performance',to be presented at the CRC CI conference, Gold Coast, Oct., 2004.

Kimmet, P. & Boyd, T., 'Innovative Benchmarks for Built Asset Performance – The Triple Bottom Line Approach', to be presented at the CRC CI conference, Gold Coast, Oct., 2004.

Kimmet, P., 'Disclosure and the triple bottom line appraisal of built assets', to be presented at the CRC CI conference, Gold Coast, Oct., 2004.

Kimmet, P., 'Measuring the Sustainability of Buildings: Understanding the triple bottom line', to be presented at the CRC CI conference, Gold Coast, Oct., 2004.

Team Presentations

'Evaluating Risk in Property Feasibility Studies', industry presentation at QUT, Brisbane, June 2003.

'The Evaluation of Functional Performance in Commercial Buildings', final project presentation to industry partners, QUT, Brisbane, 21 May 2004.

3.5.6 Scope for further research

This study has highlighted the need for further research in the field of:

1. the projection of rental growth rates
2. the probability profiles of key input variables within a simulation exercise
3. the social indicators and measures for the assessment of the triple bottom line, and
4. the extension of the cash flow and risk analysis study to incorporate portfolio analysis.

Projection of rental growth rates

The report has mentioned the difficulty of using existing forecast models and has specified a growth model that has been tested over the relatively short period of the project. This model should be tested over a longer period of time and further variables considered as and when the demographic data is improved. In addition Systems Dynamics should be researched as a possible means of providing a more reliable and self-adjusting technique for the rental growth projections.

Probability profiles

The probability profiles used in this study were the commonly accepted triangular and normal distribution profiles. The research did not indicate that more sophisticated profiles produced a more accurate result in the case studies. However further research into the effects of different profiles and the impact of the interdependency of key variables should be undertaken to test the accuracy of the simulation exercise using different property case studies

Social Indicators

As mentioned earlier, only limited pioneering work has been undertaken on the measurement of social indicators. Much more research needs to be undertaken on the market reaction to

social indicators. This research will take time, but the current research being carried out in the UK by RICS Foundation and Kingston University should be monitored and replicated, where possible, in Australia. This research should be linked to the current research being undertaken on environmental indicators.

Portfolio Analysis Studies

The study by Parker indicated that many fund managers developed their own portfolio analysis structure. There should be consideration of the weighting of property specific risk components within a portfolio in conjunction with the risk adjusted cash flow evaluation, in order to improve the decision making process for property assets held in portfolios.

4. CONCLUSION

The project output is in line with the original expectations of the research study. An innovative risk-adjusted cash flow has been produced and guidance is provided on the key variable inputs of the study. Certain aspects of the research, in particular the forecasting of key variable change and the determination of the social metrics, proved more complex than anticipated, but the project made substantial advancement in these challenging fields.

This project was able to complete the milestones and work within the budget because of the extraordinary efforts of the research associates and the industry partners. This is particularly gratifying as the linking of academic research and industry experience is not easy because of the differing viewpoints.

The single most important finding of this study is the future focus on the triple bottom line as the standard for performance evaluation. Once the TBL performance is determined, the evaluation process, which has up till now taken a narrow, economic bottom line approach, will be fundamentally challenged to embrace the TBL. The extent to which appraisal figures themselves will be impacted is yet to be known, and will depend on how quickly and how seriously the market responds to the rapidly changing socially and ecologically sensitive institutional environment. One thing is clear though, it is only by paying close attention to these institutional changes and developing the right indicators that the property owner/manager will keep abreast of these market changes. The buildings that perform exceptionally will begin to attract fund managers keen to improve their service to customers by providing access to an 'ethical' property fund. Over time, this could profoundly challenge the way all commercial property is built, managed and disposed.

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6. GLOSSARY

brownfield	urban redevelopment site
ethical investment	usually an institutional investment that screens out undesirable prospective investments (ie. Gaming, alcohol, tobacco etc.)
good governance	efficient, transparent and accountable economic management taking account of due social and environmental considerations
green buildings	new or renovated buildings with specific ecologically-based design and management features
greenfield	development site that has not been built up previously
Green Star	Green Building Council's office rating tool measuring environmental performance
greenwashing	environmental reporting that focuses on positive environmental achievements while understating negative outcomes
natural capitalism	an alleged new economy based on sustainable enterprise
social responsibility	demonstration of broad community concerns in decision making
sustainable development	people centred development based on renewable resources
triple bottom line (TBL)	a framework for achieving best practice targets in economic matters, and the social and physical environments

7. APPENDICES

7.1 Appendix I.I – OFFICE RENT MODELS – EQUATIONS / RESULTS

Researcher(s)	Year	Equations (Researchers' Notation)	Key		Data	Results (Rent)
Rosen KT	1984	$R_t = f(V^*_t - V_t, P^*_t)$ where $V^*_t = f(i_t, R^e_t)$ and $\Delta SQFT_t = f(V_t, R^e_t, CC_t, I, TAX)$	R_t = change in net rents V^*_t = optimal vacancy rate V_t = actual vacancy rate P^* = change in price level R^e_t = expected rent levels	i_t = interest rate $SQFT_t$ = occupied space CC_t = construction cost TAX = tax laws affecting real estate	San Francisco Office Rents – 1961-1981	Adjusted $R^2 = 0.55$. Said to confirm an inverse relationship between rent change and deviations between the actual and "optimal" vacancy rate and a direct relationship with the cost of living
Hekman JS	1985	$R_t = \alpha_0 + \alpha_1 Vt + \alpha_2 Y_t + \alpha_3 E_t + \alpha_4 U_t + \varepsilon_{1t}$ $Q_t = \beta_0 + \beta_1 R^*_t + \beta_2 G_t + \beta_3 C_t + \beta_4 I_t + \varepsilon_{2t}$	R_t = real rent per sq. ft V_t = vacancy rate (A Grade) Y_t = Gross National Product E_t = total employment (local) Q_t = value of office permits G_t = office employment ratio	U_t = unemployment rate (local) C_t = construction cost per sq. ft I_t = interest rate ratio	14 US cities – 1979-1983	$R^2 = 0.40$ with lags. Overreactions of supply to market signals, such as high rents, perceived to create periods of sustained low or high vacancy rates and rents.
Shilling J, Sirman C & Corgel J	1987	$R = b_0 + b_1 E - b_2 V$ where $b_0 = b_2 V^n$	R = change in rents E = change in operating expenses V = observed vacancy rate V^n = normal vacancy level		17 US cities – 1960-1975	R^2 ranging from 0.66 to 0.98 for cities. Vacancies said to play an important role in responding to demand fluctuations and in setting short-run prices (significant at 90% for 11 of 17 cities).
Wheaton WC & Torto RG	1988	$R(t)/R(t-1) - 1 = a[b + ct - V(t)]$	R(t) = real rent (average effective) V(t) = vacancy rate b + ct = "structural" vacancy rate	a = speed of adjustment parameter	National US rent and vacancy data (spliced) – 1968-1986	$R^2 = 0.78$. Excess vacancy said to have strong relationship with rents. Indicated "structural" vacancy rate had risen over time. Provided seven forecast for office rent.
Frew J & Jud GD	1988	$R_t = f(V_t, D_t, A_t, F_t, C_t, H_t)$	R_t = marginal rental rate V_t = vacancy rate D_t = distance from CBD A_t = building age	F_t = number of floors C_t = % common area H_t = location adjacent major thoroughfare / highway (dummy)	Survey of 66 buildings in Greensboro, USA	Adjusted R^2 ranging from 0.49 to 0.58 depending on data format. All variables, except "common area " and "distance from CBD" found to be significant.
Gardiner C & Henneberry J	1988	$RR_t = a + b.GDPR_t + c.GDPR_{t-2} + d.FSR_t$	RR_t = rent level GDP = Gross Domestic Product	FSR = ratio of regional floor space to total national floorspace	Eight UK regions – office rent index – 1977-1984	R^2 ranging from 0.397 to 0.975 for the eight regions. Model had difficulty in forecasting rents for a declining region.
Gardiner C & Henneberry J	1991	$R_t = \alpha(1 - \lambda_1)(1 - \lambda_2) + (\lambda_1 + \lambda_2)R_{t-1} - \lambda_1\lambda_2 R_{t-2} + \beta(1 - \lambda_1)(1 - \lambda_2)D_t + (u_t - \lambda_2 u_{t-1})$	R_t = rent bid λ_1 = "adaptive expectation" parameter (0-1) D_t = demand for floorspace	λ_2 = "partial adjustment" parameter (0-1)	Eight UK regions – office rent index – 1977-1984	R^2 ranging from 0.51 to 0.98 for combined "habit persistence" model. Model said to improve forecasts for declining regions.

Researcher(s)	Year	Equations (Researchers' Notation)	Key		Data	Results (Rent)
Dobson SM & Goddard JA	1992	$log R_t = a + b.log R_{t-1} + c.log R_{t-2} + d.log I_t + e.log H_t + \varepsilon_t$ (+ regional dummies)	R_t = rent index (inflation adjusted) I_t = real interest rate (spread) H_t = house price index (local)		Four UK regions – 1972-1987	Adjusted $R^2 = 0.94$. Interest rates and house prices said to have positive effects on office rents.
Glascock JL, Kim M & Sirmans CF	1993	$y_t = X_t\beta + v_t y + W\delta + \xi t J_T + u_t$	y_t = average real rent X_t = constant and variable that vary over time periods and individual buildings	v_t = location characteristics w_t = market condition variables	Baton Rouge, USA – six sub-markets – 1984-1989	Used random effects and heteroscedastic autoregressive models. Suggested rent process different across time and building classes. Assumption of parameter constancy is not supported.
Giussani B & Tsolacos S	1993	$\Delta_1 RERV = \alpha_0 + \alpha_1 A_4(\Delta_1 GDP) + \alpha_2[(\Delta_1 BFI_{t-5} + \Delta_1 BFI_{t-6})/2] + \alpha_3 \Delta_1 PROF_{t-2} + \alpha_4[(\Delta_1 NO_{t-26} + \Delta 1 NO_{t-27})/2] - \alpha_5 UNCER$	RERV = estimated rental value GDP = real Gross Domestic Product BFI = employment (banking, finance and insurance)	PROF = market conditions index (tender price – building cost) NO = office buildings new orders UNCER = uncertainty	UK quarterly rent index – 1971-1991	Adjusted $R^2 = 0.67$. Indicated most significant variable to be uncertainty (4th quarter standard deviation of change in GDP), followed by GDP and employment.
Hendershott PH, Lizieri CM & Matysiak GA	1996	$\%dR = \alpha + \lambda v + \beta (R^* - R)$ where $R^* = (r + dep + oper)RC$ and $\alpha = -\lambda v^*$ $Completions = \alpha + \beta(Gap_{t-1} + Gap_{t-2})$	%dR = % change in real effective rents v = actual vacancy rate R* = equilibrium rent r = real interest rate v* = equilibrium vacancy	dep = depreciation rate oper = operating expense ratio RC = replacement cost Gap = R* - R	City of London prime office face rents – 1977-1995	Adjusted $R^2 = 0.58$. Real effective rents considered to be mean reverting, responding to gaps between actual and equilibrium rents and actual and natural vacancy rates.
DiPasquale D & Wheaton WC	1996	$R_t - R_{t-1} = \mu_3(R^* - R_{t-1}) = \mu_3(\mu_0 - \mu_1 V_{t-1} + \mu_2 AB_{t-1}/S_{t-1}) - \mu_3 R_{t-1}$ Where: $AB_t = \tau_1[\alpha_0 + E_t[\alpha_1 + \alpha_2 \frac{(E_t - E_{t-1})}{E_t} - \alpha_3 R_t]] - \tau_1 OC_{t-1}$	R_t = current rent R* = equilibrium rent V_{t-1} = vacancy rate previous period S_{t-1} = total stock previous period	AB_{t-1} = net space absorption previous period E_t = number of office workers at time t τ_1 = occupier space change adjuster	San Francisco office rent index – 1980-1992	$R^2 = 0.73$. Equation developed as part of econometric model. Given a stock of space and a level of office employment, the equation was said to depict how rents adjust to equate office demand to a given stock of space.
Hendershott PH	1997	$(g_t - g_{t-1}) / g_{t-1} = \lambda_1 (v^* - v_{t-1}) + \lambda_2 (g^*_t - g_{t-1})$	g_t = actual real effective rent rate g^*_t = equilibrium real effective rent rate λ_1 & λ_2 = positive adjustment coefficients	v_t = actual vacancy rate v* = natural vacancy rate (assumed to be constant over time)	Sydney annual rent data – 1970-1992	$R^2 = 0.68$. Percentage change in effective rents was related to the gaps between actual and equilibrium rents and actual and natural vacancy rates.
Dunse N & Jones C	1998	$R(z_k) = \beta_0 + \sum_{i=1}^{N} \beta_i z_{ik} + \varepsilon_i$	$R(z_k)$ = rent for space in kth building z_i = individual characteristics of space (25 variables	including area, age, location, physical building aspects)	Glasgow – 477 asking rents – 1994-1995	Adjusted $R^2 = 0.61$. Studied aimed at identifying and quantifying the contribution of different explanatory attributes to office rents. The results were said to emphasise the importance of age and location as the principal rent determinants.

Researcher(s)	Year	Equations (Researchers' Notation)	Key		Data	Results (Rent)
D'Arcy E, McGough T & Tsolacos S	1999	$\Delta rent_t = \alpha_0 + \Sigma\alpha_{1i}\Delta gdp_{t-i} + \Sigma\alpha_{2i}\Delta sse_{t-i} + \Sigma\alpha_{3i}ofnc_{t-i} + e_t$	Rent = real rent gdp = Gross Domestic Product sse = service sector employment	ofnc = volume of new office completions (first differences and natural logs)	Dublin prime rack (effective) rents – 1971-1997	Adjusted $R^2 = 0.49$. Service sector employment found not to be significant. Key determinants of office rents said to be GDP (lagged one year) and new space (lagged three years).
Hendershott PH, Lizieri CM & Matysiak GA	1999	$\Delta R\% = \alpha + \lambda v + \beta (R^* - R)$ where $R^* = (r + dep + oper)$ and $\alpha = -\lambda v^*$ Completions = $\alpha + \beta(Gap_{t-1} + Gap_{t-2}) + \gamma$ DUM	$\Delta R\%$ = change in real effective rents v = actual vacancy rate R^* = equilibrium rent r = real interest rate v^* = equilibrium vacancy	dep = depreciation rate oper = operating expense ratio RC = replacement cost Gap = $R^* - R$	City of London – real new prime effective rents – 1975-1996	Adjusted $R^2 = 0.69$. Real effective rents said to respond to gaps between actual and equilibrium rent levels and actual and natural vacancy rates. Construction and absorption said to feed back onto rents through their effects on the vacancy rate.
Wheaton WC	1999	$R_t = (S_t/\alpha_1 E_t)^{-1/\beta}$	R_t = rent per ft² S_t = office space stock E_t = employment β = elasticity of demand		Not provided	Assumes market clears with demand equal to existing stock and no vacancy. Part of a multi-equation stock flow model examining simulations rather than statistical analysis.
Chaplin R	2000	DLROHP = CONST + α.DLROHP(-1) + β.DLRBFQ1 + γ.DLRONOQ1(-1) + δ.DLRONOQ1(-2) + error	DLR = first difference and natural logs used OHP = office rent index BF = output of business and finance sector	ONO = office building new orders	Great Britain – office rent index	Adjusted $R^2 = 0.51$ (average). 15 model permutations tested. "Naïve competitors" often beat the best fitting models and these were unable to predict the correct timing of market changes.
Murray J	2000	$\Delta R_t = \alpha_0 + \alpha_1 \Delta V_{t-1} + \alpha_2 V_t + \alpha_3 \Delta S_t + \varepsilon_{1t}$	ΔR = change in prime effective rent V = vacancy rate as % ΔS = change in office space supply		Sydney vacancy and rent data – 1978 – 1997	Adjusted $R^2 = 0.69$. Results indicated one percent rise in vacancy rate was expected to reduce rent growth by 0.78%. An additional 100,000m² in stock was expected to reduce rental growth by 8.7%.
MacFarlane J, Murray J, Parker D, & Peng V	2002	$\ln(R_{t-2}^{e,t}/R_{t-2}) = \beta_0 + \beta_1 \Delta Y_{t-2} + \beta_2 \Delta VAC_{t-2} + r_t$ $R_t = \beta_0 + \beta_1 VAC_{t-1} + \rho\, e_{t-1} + r_t$ $COMP_t = \beta_1 DEP_{t-1} + \beta_2 DEP_{t-2} + \beta_3 DEP_{t-3} + \beta_4 VAC_{t-3} + \beta_5 \Delta VAC_{t-3} + \beta_6 RERENT_{t-3} + \beta_7 \Delta RERENT_{t-3} + r_t$	$R^{e,t}$ = expected real effective rent R = real effective rent Y = 10 year bond rate VAC = vacancy COMP = Completions DEP = withdrawals / demolitions	RERENT = real effective rents	Sydney rent data – 1977-2000	Adjusted $R^2 = 0.49$ (expected change in rents). Adjusted $R^2 = 0.90$ (rent estimation). Equations are variations of the RICS (2000) econometric model equations for London. Vacancy rates found to have strong influence on Sydney rents. Bond yields said to be insignificant.
Hendershott PH, MacGregor BD & Tse RYC	2002	$\Delta \ln R_t = \alpha_0 + \alpha_1 \Delta \ln E_t + \alpha_2 \Delta \ln(1 - v_t) + \alpha_3 \Delta SU_t + \alpha_4 \{ \ln R_{t-1} - \beta'_0 - \gamma'_1 \ln E_{t-1} - \gamma'_2 \ln[(1 - v_{t-1})SU_{t-1}\}$	R = real effective rent E = employment V = vacancy rate SU = space supply		Sydney and London market data – 1977-1996	Adjusted $R^2 = 0.70$ to 0.80 for long-run error correction model. Vacancy and rent equilibrium variables were said to be highly significant in determining rent adjustments. Introduced time-varying equilibrium rent as explanatory variable.

Researcher(s)	Year	Equations (Researchers' Notation)	Key	Data	Results (Rent)
Tse RYC & Fischer D	2003	$g_t = \alpha v_{nt} - \alpha v_t + \varepsilon v$ Where $v_{nt} = v^* + \epsilon_v$	g = rent growth rate v_n = natural vacancy rate v = vacancy rate v* constant parameter ϵ_v = time-varying constant	Hong Kong (1975-1997), Sydney (1970-1996), Perth (1992-1994 monthly) & London (1975-1996)	Adjusted R^2 ranging from 0.36 to 0.611 for the four cities. Introduced time-varying vacancy rate. Static vacancy rates were said to exaggerate cyclical swings in rental growth rates. The "stationary component" of vacancy rates was said to vary across cities.

7.2 Appendix I.II – OFFICE SPACE MODELS – EQUATIONS / RESULTS

Researcher(s)	Year	Equations (Researchers' Notation)	Key		Data	Results
Rosen KT	1984	$\Delta SQFT_t = f(V_t, R^e_t, CC_t, i, TAX)$ where OSQFT*t = (EMPit, Rt/Pt)	$\Delta SQFT$ = new space supply V_t = actual vacancy rate P = overall price level R^e_t = expected rent levels i_t = interest rate	$OSQFT_t$ = occupied space CC_t = construction cost TAX = tax laws affecting real estate	San Francisco data – 1961-1983	Adjusted $R^2 = 0.19$. Weak result attributed to new construction being classified as highly volatile and difficult to explain in an equilibrium econometric model.
Hekman JS	1985	$Q_t = \beta_0 + \beta_1 R^*_t + \beta_2 G_t + \beta_3 C_t + \beta_4 I_t + \varepsilon_{2t}$	Q_t = value of office permits R_t = expected real rent per sq. ft G_t = office employment ratio	I_t = interest rate ratio C_t = construction cost per sq. ft	14 US cities – 1979-1983	$R^2 = 0.61$. Supply equation showed a strong response to the long-term growth rate of office employment and expected rent (sourced from another equation).
Wheaton WC	1987	$C_{(t)} = F2[R_{(t)}, V_{(t)}, S_{(t)}, E_{(t)}/E_{(t-1)}, C_{(t)}, I_{(t)}]$	$C_{(t)}$ = construction begun $R_{(t)}$ = real rental rate for new space $V_{(t)}$ = vacancy rate $S_{(t)}$ = stock of space I(t) = short-term finance cost	$E_{(t)}/E_{(t-1)}$ = employment growth F2 = undefined adjuster $C_{(t)}$ = cost of construction	30 US centres – 1967-1986	$R^2 = 0.91$. All variables significant except construction costs and interest rates. Variable were correctly signed, but Durbin Watson statistic suggested autocorrelation still remained in residuals. Vacancy was lagged 2.½ years and employment was lagged one year.
Gardiner C & Henneberry J	1988	$D_t^n = \mu(K_t^* - K_{t-1})$	D_t^n = net level office development starts K_t*= desired office stock K_{t-1} = available stock previous period	μ = adjuster to allow for starts at level less than that indicated by increased demand	8 UK regions – 1977-1984	Equation adapted from Barras (1983). It assumes net development starts is proportional to the excess of current desired office stock over the actual stock available in the previous period.
Hendershott PH, Lizieri CM & Matysiak GA	1996	$Compl = \alpha + \beta(Gap_{t-1} + Gap_{t-2}) + \gamma$ DUM (1979-1996)	Compl = completions Gap = value of the variation between actual and equilibrium rent levels		London data – 1979-1996	Adjusted $R^2 = 0.82$. "Gap" said to have large and significant effect in equation. A dummy variable was also added to capture the "bounce and reversal" of completions in 1989-1990.
DiPasquale D & Wheaton WC	1996	$C^*_t = \beta_0 + \beta_1 S_{t-8} + \beta_2 S_{t-8} V_{t-8} + \beta_3 AB_{t-8}$ $C_t - C_{t-1} = \tau_2(C^*_t - C_{t-1})$ $C_t = \tau_2(\beta_0 + \beta_1 S_{t-8} + \beta_2 S_{t-8} V_{t-8} + \beta_3 AB_{t-8}) + (1 - \tau_2)C_{t-1}$	C^*_t = level of desired completions S_{t-8} = total space lagged 4 years V_{t-8} = vacancy rate lagged 4 years	τ_2 = adjustment rate to account for gradual response by construction AB_{t-8} = net space absorption lagged 4 yrs	San Francisco – 1980-1992	$R^2 = 0.61$. Equation is part of econometric model. Absorption determined by separate equation driven by office employment and vacancy. Authors considered it reasonable to assume that the desired level of completions, as a % of stock, was dependent on the anticipated rents at the times of projects' deliveries.
Wheaton WC, Torto RG & Evans P	1997	$C_t = \beta_0 + \beta_1 R_t + \beta_2 V_t + \beta_3 I_t + \beta_4 RC_t$	C_t = new investment or construction orders R_t = office rents V_t = vacancy RC_t = replacement cost	I_t = interest rate or capitalization rate series	London – 1976-1994	$R^2 = 0.88$. Assumption made that the level of new construction would depend on office building values relative to replacement costs. In turn, values were based on property net income and capitalisation rates. Interest rates were found to have little statistical relevance.

Researcher(s)	Year	Equations (Researchers' Notation)	Key		Data	Results
Viezer TW	1999	$NEW_{p,m,t} - RMV_{p,m,t} = \alpha_{p,m,7} + \beta_7(STK_{p,m,t-L} - OCC_{p,m,t-L}) + \gamma_7(MSF\$_{p,m,t-L} - CST\$_{p,m,t-L}) + \sum_{t=1}^{T-1} \delta YRDUM_t + \varepsilon_t$	NEW = construction completions (p-property type, m-market, t-year) RMV = removals STK = stock of space	MSF$ = market value / ft² CST$ = replacement cost / ft² in real dollars	51 US office markets – 1985-1996	Adjusted $R^2 = 0.83$. In addition to the inclusion of a lagged vacancy measure, the equation provided a linkage between market value and replacement cost indicating new supply was triggered when value exceeded cost.
Tsolacos S & McGough T	1999	$\Delta_1 OFBO_t = \beta_0 + \Sigma\beta_i\Delta_1 OSER_{t-i} + \Sigma\beta_j\Delta_1 RENT_{t-I} + \Sigma\beta_h EUNC_{t-h} + \Sigma\beta_k RUNC_{t-k} + \varepsilon_t$	Δ_1 = first difference operator OFBO = construction output in constant $ OSER = output of service industries RENT = real rent	EUNC = economic uncertainty (moving standard deviation of GDP) RUNC = rent uncertainty	National UK data – 1979-1996	Adjusted $R^2 = 0.61$. Model included measures of uncertainty (standard deviations) to reflect unpredictable components of economic and office market trends. Lagged rent and service industries output considered to be construction drivers. Vacancy variable omitted due to lack of data.
Sivitanidou R & Sivitanides P	2000	$CC = \alpha_0 CC(l) + \alpha_2 INCOME(n) + \alpha_3 GROWTH(n) + \alpha_4 VOLG(n) + \alpha_5 RATE(n) + \alpha_6 CCI(n) + \alpha_7 SPATIAL + \alpha_8 CLIMATE + u(n)$	CC = commercial construction in ft² INCOME = real rent in $/ft² GROWTH = average office employment growth rate (5 years) VOLG = standard deviation office employment growth (5 years)	RATE = average inflation adjusted 10 year Treasury rate in % CCI = construction cost index SPATIAL = average commuting time CLIMATE = average annual temperature	15 largest US office markets – 1982-1998	Dummy variables for fixed regional effects were also incorporated. The explanatory variables were said to be statistically significant in most model variants. Lags for office supply were said to be long with 80% of investments not being realized until 3.4 to 3.6 years after initial investment decisions. Rent, risk free rates and office employment growth and volatility were said to have the most impact on construction activity.
MacFarlane J & Moon S	2000	$CM_{(t+a1)} = [a_6 + a_7 * (V^* - V_{(t)})] * S_{(t)}$	CM = construction completed S = stock of space V = vacancy rate V* = structural / equilibrium vacancy	a_1 = lag between favorable market and new space appearing on market	Australian eastern capital cities – 1970-1998	Statistical details not given for fit of model. Noted lack of data over a sufficient time span for modelling. Indicated the application of data from all of the eastern capital cities was superior than applying data from individual cities.
MacFarlane J, Murray J, Parker D. & Peng V	2002	$COMP_t = \beta_1 DEP_{t-1} + \beta_2 DEP_{t-2} + \beta_3 DEP_{t-3} + \beta_4 VAC_{t-3} + \beta_5 \Delta VAC_{t-3} + \beta_6 RERENT_{t-3} + \beta_7 \Delta RERENT_{t-3} + r_t$	COMP = completions DEP = depreciation / withdrawals VAC = vacancy RERENT = real effective rent		Sydney data – 1970-2000	Adjusted $R^2 = 0.82$. Adaptation of the RICS London market model to the Australian context. Building starts and building approvals excluded due to a lack of data for Sydney. Vacancy and real rent lagged three years were found to be the most significant variables.
Tse RYC & Webb JR	2003	$\Delta sg_t = b_0 + b_1 ag_t + b_2 v^*_t + b_3(v^*_t - v_t) + b_4 k_t + b_5 sg_{t-1} + \xi_t$	Δsg_t = change in space supply growth ag_t = current space absorption v = vacancy rate v^* = expected vacancy rate	k = cost of capital consumption (interest rate)	National US data – 177-1996	Adjusted $R^2 = 0.94$. Authors' model also presented an absorption equation based on office employment growth. Stated that their model fulfilled their goals in determining the interrelationships among the variables.

7.3 Appendix II - MODEL INSTRUCTION MANUAL

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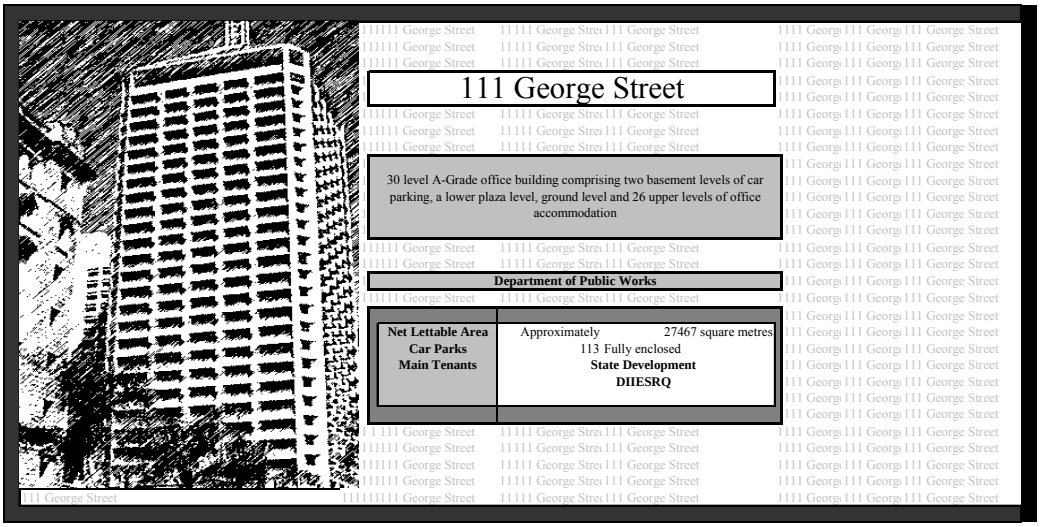
THE EVALUATION OF FUNCTIONAL PERFORMANCE IN COMMERCIAL BUILDINGS

COOPERATIVE RESEARCH CENTRE FOR CONSTRUCTION INNOVATION PROJECT

MODEL INSTRUCTION MANUAL



PROJECT PARTNERS

QUT
Queensland Government
Department of Public Works
ARUP
Rider Hunt

University of Western Sydney
Bringing knowledge to life

CONTENTS

1.0 Introduction

The commercial building evaluation model has been designed to satisfy a number of objectives, including:

- User guided value assessment tool for office buildings;
- Decision support tool for property owners through demonstrating the valuation / investment return impacts of tenancy, operating expenditure and capital expenditure decisions;
- Provision of guidance on forecasting and selection of key model variables including rent growth rates, inflation, terminal capitalisation rates and discount rates;
- Graphical representation of buildings' performance in terms of industry operating expense benchmarks;
- Incorporation of an innovative, professionally developed capital expenditure projection format;
- Clear account of lessee incentive and letting up allowances over the life of the cash flow study;
- Presentation of clear linkages between office building physical and financial performance;
- Consolidated scheduling of monthly and annual income, outgoings and net cash flow projections for the term of the cash flow study;
- Graphical output comparing forecast: gross and net income; market and lease rents; and operating and capital expenditure;
- Sensitivity analyses generated through Crystal Ball® software using Monte Carlo simulation processes; and
- Built-in rent forecasting module to provide guidance on rent growth for the Brisbane CBD.

The structure of the cash flow model is summarised in the following table:

Component	Purpose	Inputs / Outputs
① Key Assumptions	Sets parameters for assigning and forecasting market and economic variables.	• Property holding period • Market derived discount rate • Terminal capitalisation rate • Financing parameters • Inflation forecast • Rent (office, retail, car park and other) forecasts • Building vacancy and bad debt allowances • Lease incentive and letting up allowances
② Lease Schedule	Schedules building commercial lease details.	• Lessee names and locations within building • Lease floor areas • Annual rents • Car park allocations and rents • Commencement, expiry dates and lease terms • Rent review mechanism details
③ Income Schedule	Forecasts market rent for each tenancy sourcing data from the assumption and lease schedules. Forecasts lease rents, accounting for rent reviews and lease expiries, sourcing data from the market rent schedule.	• Monthly market rent forecast for each tenancy over cash flow horizon • Monthly rent escalation percentage for office and retail space and car parks • Monthly lease rents over cash flow horizon for office and retail space and car parks
④ Operating Expense Schedule	Lists one year forecast of statutory and non-statutory building operating expenses and compares them with industry benchmarks.	• Listing of individual statutory charges and operating expenses • Calculation of rates per square metre per annum for each expense • Listing of PCA benchmarks for each expense and graphical comparison with actual building expenses
⑤ Capital Expenditure Schedule	Professionally developed building capital expenditure projections over cash flow horizon.	• Tabulated projections of annual expenditure on ▪ Building fabric and finishes; ▪ Civil, structural and façade engineering; ▪ Building Code of Australia compliance items; ▪ Compliance with Disability Discrimination Act; and ▪ Building services engineering. • Graphical representation of categorised annual capital expenditure projections
⑥ Lease Incentives and Letting Up Allowances	Monthly projections of leasing inducements and agents' commissions for space vacancies over cash flow horizon.	• Lease incentives and letting up allowances for individual tenancies based on assumptions sourced from assumption sheet

Component	Purpose	Inputs / Outputs
⑦ Discounted Cash Flow Analysis (Monthly)	Consolidated forecast of monthly building income and expense data over the cash flow horizon to derive net cash flow. Future net monthly cash flow is discounted back at the specified discount rate (assumption schedule) to calculate a present value.	• Monthly building gross income projections sourced from income schedule including: ▪ Retail rent; ▪ Commercial rent; ▪ Naming rights fees; ▪ Communication carrier income; and ▪ Storage rent. • Monthly building expense projections sourced from expense schedules including: ▪ Operating expenditure; ▪ Bad debt and vacancy allowances; ▪ Incentives; ▪ Agents commissions; and ▪ Capital expenditure
⑧Discounted Cash Flow Analysis	Consolidation of monthly DCF schedule to annual income, expense and net cash flow figures.	• Same figures (as above) for monthly DCF analysis presented in annual form.
⑨Property Council of Australia Operating Costs Benchmarks	Tabulated summary of operating costs benchmarks for Brisbane CBD buildings of three size ranges and two building grade ranges.	• Serves as an automated output to the operating expense sheet, allowing the subject building's operating costs to be benchmarked against industry averages sourced from a substantial sample of Brisbane CBD buildings
⑩Charts	Illustrative charts linked to the cash flow study showing the buildings projected performance based on the assumptions adopted in the model.	• Output charts including: ▪ Total gross income / net cash flow comparison; ▪ Forecast building rent / market rent comparison; ▪ Forecasting operating expenditure; and ▪ Sensitivity analysis – variations in terminal capitalisation rate and discount rate
⑪Guide to Forecasting and Variable Selection	Qualitative and quantitative advice on forecasting rent, terminal yield and inflation rates and selecting discount rates.	• Property professional sourced determinants of terminal capitalisation rates and quantitative ranges of current rates for the Brisbane CBD • Sources of inflation rate forecasts and a graphical representation of historical rates for the Brisbane CBD • Property professional sourced determinants of discount rates and a quantitative range of current rates for the Brisbane CBD • Guidance on the formulation of rent forecasts including an equation estimated for the Brisbane CBD
⑫Rent Forecasting Model	Statistical regression tool to generate a five year rental rate forecast for the Brisbane CBD subject to some user inputs.	• Calculation tool for estimating rent forecasts based on the results generated by the equation described in sheet ⑪

Component	Purpose	Inputs / Outputs

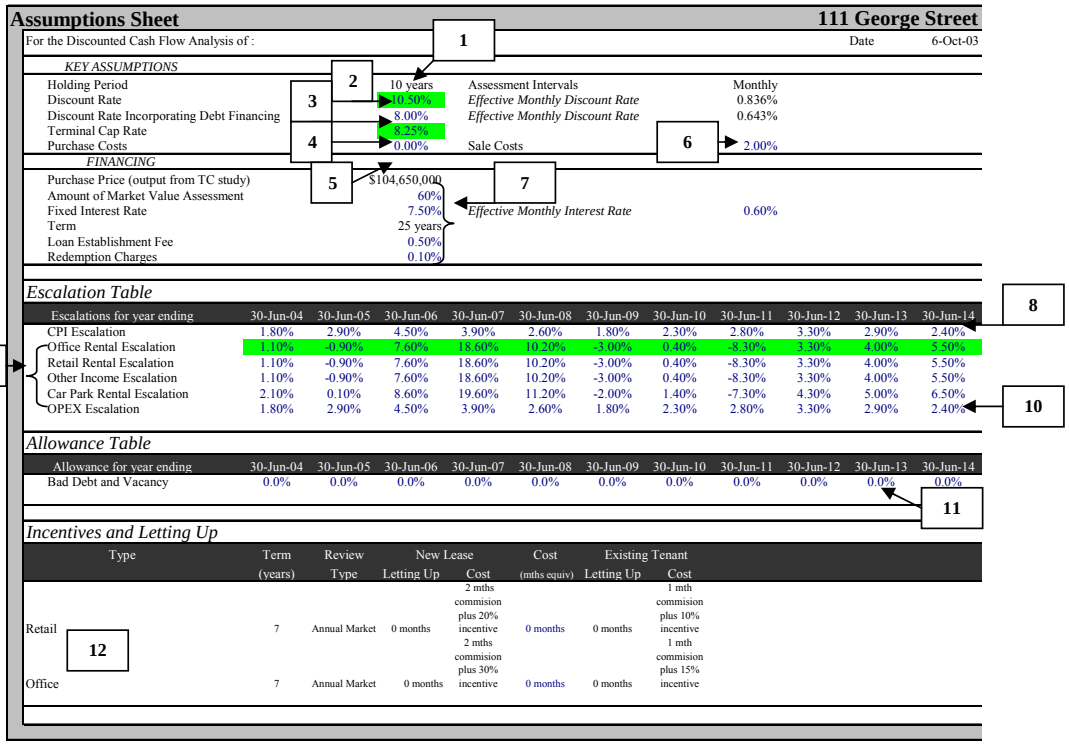
⑬Environmental Benchmarks	Schedules environmental benchmarks for commercial buildings.	• Benchmarks nominated including:
		  • Resource consumption;
		  • Design; and
		  • Governance.

⑭Social Benchmarks	Schedules social benchmarks for commercial buildings	• Benchmarks nominated including:
		  • Health and safety;
		  • Stakeholder relations;
		  • Community engagement;
		  • Accessibility;
		  • Occupier satisfaction and productivity;
		  • Cultural issues; and
		  • Local impacts.

⑮Sensitivity / Simulation Analysis	Detailed key variable sensitivity / simulation (Monte Carlo) analysis run via Crystal Ball software	• Generates charts and detailed statistical analyses on the results of fluctuations in key variables such as rent growth rates, discount rates and terminal capitalisation rates.

2.0 Assumption Sheet

The assumption sheet sets the key parameters for assigning and forecasting property market and economic variables as a basis for the cash flow study. After opening the Excel file, the assumption sheet is selected by clicking on the "ASSUM" worksheet tab at the bottom of the screen. The following screen will appear:



Assumptions Sheet — **111 George Street**

For the Discounted Cash Flow Analysis of : — Date 6-Oct-03

KEY ASSUMPTIONS

Holding Period	10 years	Assessment Intervals	Monthly	
Discount Rate	10.50%	*Effective Monthly Discount Rate*	0.836%	
Discount Rate Incorporating Debt Financing	8.00%	*Effective Monthly Discount Rate*	0.643%	
Terminal Cap Rate	8.25%			
Purchase Costs	0.00%	Sale Costs	2.00%	

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Purchase Price (output from TC study)	$104,650,000		
Amount of Market Value Assessment	60%		
Fixed Interest Rate	7.50%	*Effective Monthly Interest Rate*	0.60%
Term	25 years		
Loan Establishment Fee	0.50%		
Redemption Charges	0.10%		

Escalation Table

Escalations for year ending	30-Jun-04	30-Jun-05	30-Jun-06	30-Jun-07	30-Jun-08	30-Jun-09	30-Jun-10	30-Jun-11	30-Jun-12	30-Jun-13	30-Jun-14
CPI Escalation	1.80%	2.90%	4.50%	3.90%	2.60%	1.80%	2.30%	2.80%	3.30%	2.90%	2.40%
Office Rental Escalation	1.10%	-0.90%	7.60%	18.60%	10.20%	-3.00%	0.40%	-8.30%	3.30%	4.00%	5.50%
Retail Rental Escalation	1.10%	-0.90%	7.60%	18.60%	10.20%	-3.00%	0.40%	-8.30%	3.30%	4.00%	5.50%
Other Income Escalation	1.10%	-0.90%	7.60%	18.60%	10.20%	-3.00%	0.40%	-8.30%	3.30%	4.00%	5.50%
Car Park Rental Escalation	2.10%	0.10%	8.60%	19.60%	11.20%	-2.00%	1.40%	-7.30%	4.30%	5.00%	6.50%
OPEX Escalation	1.80%	2.90%	4.50%	3.90%	2.60%	1.80%	2.30%	2.80%	3.30%	2.90%	2.40%

Allowance Table

Allowance for year ending	30-Jun-04	30-Jun-05	30-Jun-06	30-Jun-07	30-Jun-08	30-Jun-09	30-Jun-10	30-Jun-11	30-Jun-12	30-Jun-13	30-Jun-14
Bad Debt and Vacancy	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Incentives and Letting Up

Type	Term (years)	Review Type	New Lease Letting Up	New Lease Cost	Cost (mths equiv)	Existing Tenant Letting Up	Existing Tenant Cost
Retail	7	Annual Market	0 months	2 mths commision plus 20% incentive	0 months	0 months	1 mth commision plus 10% incentive
Office	7	Annual Market	0 months	2 mths commision plus 30% incentive	0 months	0 months	1 mth commision plus 15% incentive

The following sections provide a guide to selecting the variables for the cash flow study and are indexed in accordance with the annotations above.

2.10 Key Assumptions

2.11 Holding Period 1

The holding period determines the length of cash flow study. Generally ten years is the optimum period for the study and the model has been developed to cover this period. However, adjustments can be made to the model to reduce the term. Note the requirement for the study to cover eleven years to provide for the calculation of the terminal value of the property using the net cash flow details from the eleventh year, one year beyond the end of the cash flow horizon. The study is based on monthly rests or assessment intervals.

2.12 Discount Rate [2]

The **discount rate** specified in the assumption sheet is used to discount the property's future net cash flows, including proceeds from the terminal sale, back to a present value. Discount rates are market driven, being explicit measures of investor required total returns from real estate and other assets. A 2004 survey of Brisbane CBD property professionals revealed several considerations are incorporated in the assessment of discount rates, including:

- cash flow analysis of recent investment property sales evidence to derive comparable discount rates;
- communication with institutional property investors to establish their accepted investment return parameters;
- current level of the long-term bond rate, being a proxy for the risk free investment rate, and the likely risk premium rate acceptable to property investors;
- quality of property being assessed, including standard, location, condition and lease / lessee profiles; and
- competitive returns available from alternative investments, including shares and other property assets.

Specific property discount rates are rarely published. The dominant assessors of office building discount rates are valuers and their presentation of these rates is mainly limited to valuation reports for clients. The survey noted that different valuers may use different assumptions in their analyses of rates of return for sales of investment properties. This process derives inconsistencies in analysed rates for specific properties among different firms.

As a guide, recent (2004) valuer analysed Brisbane CBD office building sales evidence has derived total rates of return in a relatively narrow band from **10%** to **12%**.

A practical guide to assessing discount rates includes the following steps:

1. Study the calculated or expected yield and terminal yield for the property. The discount rate represents a return on income and capital, thus the discount rate should be greater than the initial yield by approximately the capital appreciation expected from the property.

2. However, always remember that the market sets the discount rate as it is the expected total return required by investors. Thus the best assessment of the discount rate is from market evidence. Attempt to get the investor's expectation of return if your study is for a specific investor.

3. If the study relates to the market (instead of a study for a specific client), market evidence must be used in establishing the discount rate. There is a sophisticated risk/return approach outlined below, but this can only be used when substantial sales evidence is available.

4. The discount rate should be checked against financial benchmarks. The benchmark calculation is the risk-free rate plus risk factors for both the property sector and the subject property. As a guideline only you can take the current risk-free rate (a good proxy is the ten-year bond rate) add 2% to 3% for the property sector risk and add a further 0% to 4% for the individual property risk. Note that the property risk does not include the rent risk incorporated in the income schedule. This is not an accurate approach and can arrive at a wide range of returns, but it is a useful check exercise.

An alternative assessment approach is the risk-return approach which is explained in greater detail in Boyd (1993) and the process may be summarised as:

1. Undertake a forecast DCF exercise for several comparable sales using the sale price and expected income flow over a five to ten year period.

2. Calculate the IRR for the comparable sales and also calculate the standard deviation of the anticipated net income for the period of the study.

3. Determine the coefficient of variation (standard deviation divided by IRR) for each sales property and plot these figures on a risk/return diagram.

4. Calculate the best fit from the plots on the risk return diagram.

5. Assess the expected net income flow from the subject property over the same time period as the sales and calculate the standard deviation of the net income - this is the risk measure for the subject property.

2.13 Discount Rate Incorporating Debt Financing [3]

The discount rate used after finance cash flow analysis is assessed in the same manner as the previously outlined, but the investor would expect a higher return to allow for the additional risk of loan finance. The effective monthly discount rates are automatically calculated for the before and after finance annual rates.

2.14 Terminal Capitalisation Rate [4]

The **terminal capitalisation rate** or **yield** specified in the assumption sheet is a multiplier determining the estimated value of the property at the end of the cash flow horizon. The forecast net cash flow derived from the property during the twelve month period beyond the cash flow horizon is capitalised to estimate this value. The rate is representative of the net return investors would require, at the time, to be enticed to purchase the property. The future value of major capital works anticipated to be required at the terminal date or within two to three years beyond this date should be deducted from the value. Additionally, it may be optimal to apply a **split yield** in circumstances where it is expected wide variations in the risk attaching to two or more income streams flowing from the property would exist.

A 2004 survey of property professionals working in the Brisbane CBD revealed several determinants considered when estimating terminal yields, including:

- Current and historical property yields determined through the analysis of property sales evidence;
- Anticipated tenancy and lease expiry profile at the end of the cash flow horizon (weaker lessee covenants mean higher income risk and higher required returns / yields);
- Assumptions about the required capital expenditure at the end of the study period (eg. whether the building will be in need of refurbishment at the time);
- Existing age and condition of the property and its projected age and condition at the end of the study period; and
- Anticipated class of property and the likely investor type that would be attracted to the property at the time.

Current capitalisation rate ranges are often published by the research branches of real estate agencies and valuation firms. As a guide, a study of current Brisbane CBD office building net yields (2003-2004) found prime grade buildings ranging from 7.2% to 9.0% while secondary grade buildings ranged from **8.0%** to **10.0%**.

2.15 Purchase Costs [5]

The purchase costs include stamp duty, legal and due diligence expenses associated with the purchase of the property. In this case they are expressed as a percentage of the purchase price of the property. A rough guide for this is item is **3%** to **4%** of the purchase price, but this should be assessed on a case by case basis.

2.16 Selling Costs [6]

The selling costs include marketing costs, agents' commissions and legal expenses associated with the hypothetical sale of the property at the end of the cash flow horizon. In this case the amount is expressed as a percentage of the end sale price. A rough guide for this is item is **2%** to **4%** of the purchase price, but this should be assessed on a case by case basis.

2.20 Financing [7]

The loan parameters of the model include amount of the initial loan (as a percentage of the property purchase price); the fixed interest rate determined by reference to commercial lending rates; the term of the loan; loan establishment fee; and a percentage for redemption charges.

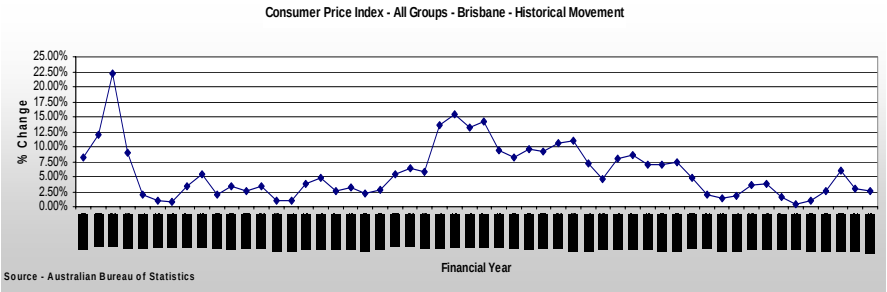
2.30 Escalations

2.31 Inflation [8]

Inflation forecasts specified in the assumption sheet are used to escalate the building's future operating and capital expenditure over the cash flow study

period. A 2004 survey of Brisbane CBD valuers found an almost universal reliance on inflation forecasts sourced from external economists. Two prominent Australian firms noted for publishing inflation forecasts include Access Economics and BIS Shrapnel. Several property researchers have recommended using a forecast average where multiple forecasts are available.

The long term average inflation rate for Brisbane since 1949 has been approximately 5.8%. However, recent inflation trends and forecasts have been at lower levels and less volatile. The chart, below, tracks the Brisbane inflation rate since 1949.

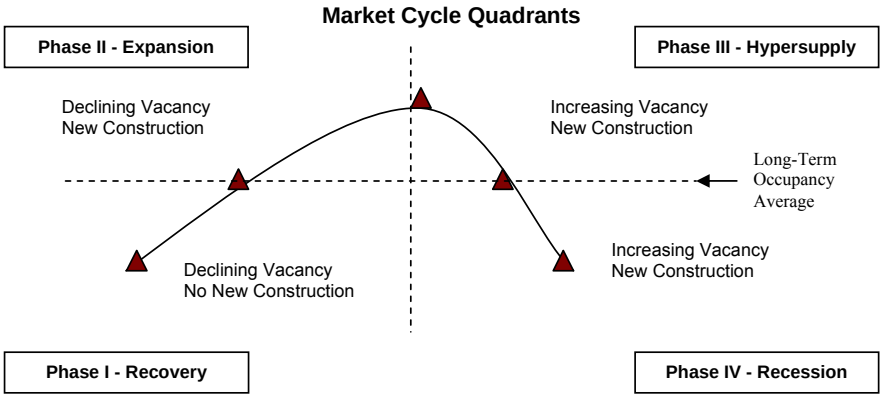


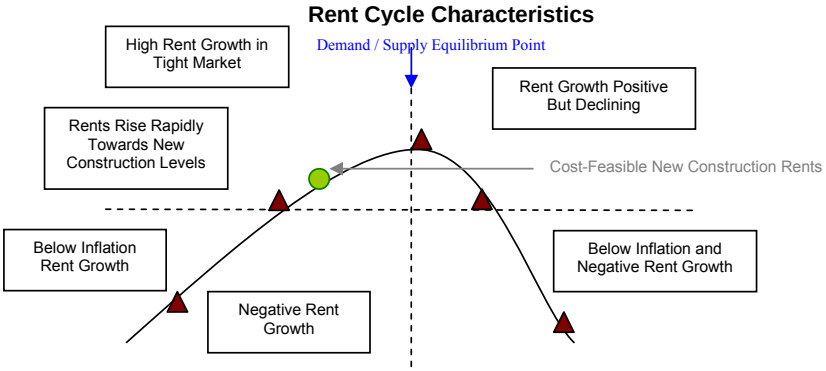
Average consumer price index forecasts indicate an average change of 2.8% to 3.2% over the next three years.

2.32 Rent Forecasts [9]

The market rent escalation rates contained in the assumption sheet stipulate the future changes in rent levels applied in the cash flow model. Forecasts are predominantly generated by modelling property market and economic leading indicators' influences on office rents. An extensive review of international office rent modelling studies has found researchers have adopted the level of vacancy, space supply and observed rent levels as the principal market determinants of future rents. The dominant economic determinants adopted have been white collar employment, economic activity and interest rates.

The current position of the market in the property cycle will influence the determination of the rental growth rates. The following diagrams, sourced from American research by Mueller (1995), illustrate an interpretation of the four property market cycle quadrants and how these can be characterised in terms of office rent growth rates.





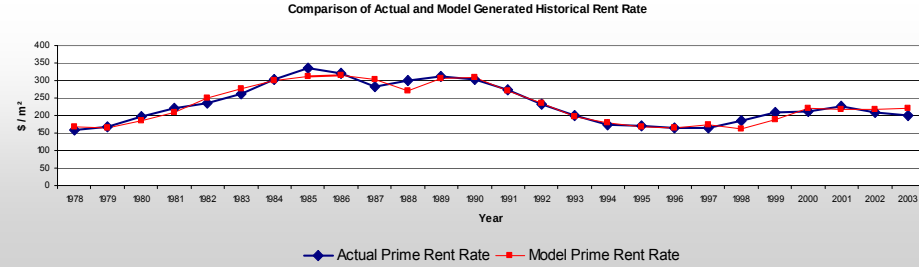
A number of firms, including Jones Lang LaSalle, BIS Shrapnel and LandMark White, give guidance on the market's position in the cycle and produce office market forecasts for sale to clients. Models from such sources are rarely published for commercial reasons. Tests of a number of published models using Brisbane CBD historical data produced unsatisfactory results. Independent research aimed at estimating a suitable model for the Brisbane CBD derived the following equation:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 V_{t-2} + \beta_3 SU_{t-2} + \beta_4 AB_t + \beta_5 I_t + \varepsilon$$

Where:

R	Prime gross effective office rent rate
V	Vacancy rate as a percentage of total stock
SU	New office supply as percentage of total stock
AB	Net office space absorption in square metres
I	Commonwealth ten year bond rate as an annual average

Statistical results indicate observed rent, lagged vacancy rate and net space absorption are particularly influential in driving the level of Brisbane office rents. This meaning reducing vacancy levels and increasing space absorption by tenants signal potential rent increases. The historical fit of the equation (with an adjusted coefficient of determination of 0.93) is strong, as demonstrated in the chart below:



A version of this model is incorporated in the rent model sheet and this requires user inputs to operate. However, property researchers have emphasized the importance of not simply relying on the output of mathematical models when generating market forecasts. There needs to be an additional qualitative input by property professionals to ensure forecasts are plausible. In addition, models need to be frequently updated and recalibrated to remain viable. As a forecast guide, the 2004 survey of Brisbane CBD valuers generated the following mean forecast for CBD prime, gross rent rates:

Year	*Forecast % Change*
2004	*+2.2%*
2005	*+3.0%*
2006	*+4.6%*
2007	*+4.7%*
2008	*+3.4%*

In formulating forecasts, some practical aspects to remember, include:

1. Substantial research shows that both macroeconomic factors and the property's characteristics will influence rent growth.
2. It is important to understand the current position in the property cycle and the state of the national and local economy. Trends in population growth (especially employment in the specific sectors), gross state (or national) product and interest rates should be studied and taken into account.
3. The property characteristics, in the particular the tenant demand for the particular space, will also strongly influence the growth rate of the rental income.
4. There is no simple formula to assess future rental growth, but the formula in the rental growth model above is a good approach using probable determinants of rental growth.
5. If it is not possible to use the rental growth model due to a lack of available data, you should assess the annual growth rate according to expected property market cycle changes and the condition of the property.
6. It is not recommended that you use a single average growth rate

for the period of the study. This does not take account of the cyclical nature of property supply and demand.

2.33 Operating Expense [10]

Operating expenses are generally increased by the forecast inflation rates, as discussed under *Section 2.31*. However, some caution needs to be exercised with forecasting statutory charges such as general rates and land tax which are linked to government rating and taxing valuations. Historically, these charges have not had a strong correlation with inflation and further adjustment may be required in their projections.

If available, a historical record of the individual property's operating expense performance should be obtained to assist in identifying whether these outgoings have been tracking inflation. In some cases older buildings will display expense growth at a higher rate than inflation. According to a survey of Brisbane valuers (2004), some valuation firms add a premium of between 0.25% to 1% over the projected inflation rates to account for higher than usual outgoings.

2.40 Allowances

2.41 Bad Debt and Vacancies [11]

Forecast bad debt and vacancy allowances should be based on historical financial performance of the property, quality of tenants and the current lease profile. Anticipated vacancies hinge strongly on the likelihood tenants will take-up lease options or renew their leases at the expiries of their current leases.

2.42 Incentives and Letting Up [12]

Letting up costs include the anticipated period (in months) it will take to lease space on it becoming vacant. They also include legal costs associated with producing lease documentation as well as any leasing agents' commissions and marketing costs. Commissions are normally calculated as a percentage of the annual gross rents and can range between 10% to 15%.

Incentives have formed part of the Brisbane CBD office space market since the 1980s. They generally take the form of a contribution towards the lessees' fit-out costs or a rent free period. Incentives levels are a factor of the position the leasing market is in the property cycles. A net present value calculation is used to determine the value of an incentive in terms of equating it to a number of years' rent. Brisbane CBD office space incentives have ranged between 1.5 years and 5 years since the 1980s based on ten year leases (15% to 50%). Incentives and agents' commissions are generally lower in cases of renewing leases to existing tenants.

3.0 Lease Schedule

The lease schedule summarises the key lease details for the subject building, including rents, lease terms, floor areas and rent review mechanisms and dates. Clicking the "LEASE SCH" tab at the bottom of the screen takes you to the relevant worksheet. The details in this schedule are user entered and automatically flow through to the rest of the analysis. A sample of a completed schedule appears below:

Lease Schedule — 111 George Street

Tenant	Level	Area psm	Gross Current Rent	Rent $/sqm	Car Parks	Car Park Rent	Naming / Signage	Storage Income	Communications	Lease Commence	Term	Option	Lease Expiry	Next Rent Review	Rent Review Mode
RETAIL TENANCIES															
Hudsons Coffee		46.0	60,000	1,304						01-Jan-03	5	5	31-Dec-07	01-Jan-04	Annual
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
COMMERCIAL TENANCIES															
Arts QLD Office	15,16	1,258.0	440,300	350	6	23,400		20,907		01-May-94				01-Jul-05	Biennial to Market
Department of Families- Central Office	6-8	3,667.8	1,283,730	350	18	70,200		20,229		01-Jul-00				01-Jul-05	Biennial to Market
DIIESRQ	B1,8,9,10,12,13,14	5,626.6	1,969,310	350	20	78,000		15,121		01-Jan-01				01-Jul-05	Biennial to Market
Disability Services QLD - Central Office	8	152.0	53,200	350						01-Jan-03				01-Jul-05	Biennial to Market
Families- Corporate Services Centre	4,5,6,7,11,12	1,832.9	641,515	350	3	11,700				01-Jul-02				01-Jul-05	Biennial to Market
Families, Aboriginals & TSI, Disabilities	12	396.1	138,635	350	5	19,500		17,422		12-Oct-96				01-Jul-05	Biennial to Market
Heritage Trails Network	15	146.6	51,310	350						01-May-01				01-Jul-05	Biennial to Market
Housing	B1,B2,1,2,3,4	2,923.0	1,023,050	350				12,703		01-Nov-02				01-Jul-05	Biennial to Market
Minister for Innovation & Information Econon	13	457.3	160,055	350	5	19,500				01-May-01				01-Jul-05	Biennial to Market
Minister for Tourism, Racing & Fair Trading	26	427.0	149,450	350	5	19,500				01-Jul-00				01-Jul-05	Biennial to Market
Pacific Film & Television	15	529.1	185,185	350	4	15,600		1,821		01-Jul-98				01-Jul-05	Biennial to Market
Premier & Cabinet	17,18	1,656.6	579,810	350	8	31,200				01-Jul-00				01-Jul-05	Biennial to Market
State Development	2,18,19,20,21,22,24,2	6,424.1	2,248,435	350	34	132,600		4,759		01-Jul-00				01-Jul-05	Biennial to Market
Tourism, Racing & Fair Trading	18,23,26	1,924.6	673,610	350	5	19,500				01-Jul-00				01-Jul-05	Biennial to Market
OTHER RENTALS															
AAPT Limited									4,410	01-Sep-00				01-Sep-03	Annual to CPI
Optus Mobile Pty Ltd									9,000	01-Apr-02			31-Mar-07	31-Mar-04	Annual to CPI
PowerTel Limited									4,410	01-Jul-00				01-Jul-03	Annual to CPI
Ueaccess Pty Ltd									4,200	01-Feb-01				01-Feb-04	Annual to CPI
Total	**16**	**27,467**	**9,657,595**	**$ 352**	**113**	**440,700**	**-**	**92,962**	**22,020**						

The lease details are categorised according to tenancy use, being either office space, retail space or other rentals, such as license fees from telecommunication carriers. A summary of the data-entry fields, as annotated above, include:

1	Lessees' names
2	Level(s) / suites occupied by lessees
3	Net floor area occupied by lessees (excluding storage areas)
4	Current gross annual rent
5	Current gross annual rent rate per square metre of occupied net floor space
6	Number of car spaces included in lessees' licence agreements
7	Total annual parking licence fees per lessee
8	Annual licence fee for building naming or signage rights
9	Annual gross rent per lessee for allocated storage areas
10	Annual licence fees for telecommunication carriers sited in/on the building
11	Lease commencement dates
12	Lease initial terms in years and lessee option period terms in years
13	Lease expiry dates
14	Due date of next rent review in accordance with lease terms
15	Rent review mechanisms specified in lease agreements
16	Total area, total income and an average rent rate are calculated on the base line of the schedule

Relevant names and financial details from the lease schedule flow through to the "Income Schedule" discussed in the next section.

4.0 Income Schedule

The income schedule sources information and financial details from the assumption sheet and the lease schedule to plot, on a monthly basis, the forecast market rents for each of the space / use categories. A schedule of the properties forecast gross income streams is then derived from market rent schedule. The forecast income schedule incorporates the anticipated rent reviews for each of tenancies. The rent calculations require user input in the relevant months in the schedule.

Clicking the "INCOME SCH" tab at the bottom of the screen takes you to relevant worksheet and an extract from a sample worksheet is presented below:

Income Schedule

Estimated Gross Market Rentals

Tenant	01-Jul-03 31-Jul-03	01-Aug-03 31-Aug-03	01-Sep-03 30-Sep-03	01-Oct-03 31-Oct-03	01-Nov-03 30-Nov-03	01-Dec-03 31-Dec-03
RETAIL MONTHLY ESCALATION	*3.60%*	*0.09%*	*0.09%*	*0.09%*	*0.09%*	*0.09%*
Hudsons Coffee	5,180	5,185	5,189	5,194	5,199	5,204
0			-	-	-	-
0			-	-	-	-
0			-	-	-	-
0			-	-	-	-
COMMERCIAL ESCALATION		*0.09%*	*0.09%*	*0.09%*	*0.09%*	*0.09%*
Arts QLD Office	36,692	36,725	36,759	36,792	36,826	36,859
Department of Families- Central Office	106,978	107,075	107,173	107,270	107,368	107,466
DIIESRQ	164,109	164,259	164,409	164,559	164,709	164,859
Disability Services QLD - Central Office	4,433	4,437	4,441	4,445	4,450	4,454
Families- Corporate Services Centre	53,460	53,508	53,557	53,606	53,655	53,704
Families, Aboriginals & TSI, Disabilities	11,553	11,563	11,574	11,585	11,595	11,606
Heritage Trails Network	4,276	4,280	4,284	4,288	4,291	4,295
Housing	85,254	85,332	85,410	85,488	85,566	85,644
Minister for Innovation & Information Economy	13,338	13,350	13,362	13,374	13,387	13,399
Minister for Tourism, Racing & Fair Trading	12,454	12,466	12,477	12,488	12,500	12,511
Pacific Film & Television	15,432	15,446	15,460	15,474	15,488	15,503
Premier & Cabinet	48,318	48,362	48,406	48,450	48,494	48,538
State Development	187,370	187,540	187,712	187,883	188,054	188,226
Tourism, Racing & Fair Trading	56,134	56,185	56,237	56,288	56,339	56,391
CAR PARKING ESCALATION		*0.17%*	*0.17%*	*0.17%*	*0.17%*	*0.17%*
Arts QLD Office	1,950	1,953	1,957	1,960	1,964	1,967
Department of Families- Central Office	5,850	5,860	5,870	5,880	5,891	5,901
DIIESRQ	6,500	6,511	6,523	6,534	6,545	6,557
Families- Corporate Services Centre	975	977	978	980	982	983
Families, Aboriginals & TSI, Disabilities	1,625	1,628	1,631	1,633	1,636	1,639
Minister for Innovation & Information Economy	1,625	1,628	1,631	1,633	1,636	1,639
Minister for Tourism, Racing & Fair Trading	1,625	1,628	1,631	1,633	1,636	1,639
Pacific Film & Television	1,300	1,302	1,305	1,307	1,309	1,311
Premier & Cabinet	2,600	2,605	2,609	2,614	2,618	2,623
State Development	11,050	11,069	11,088	11,108	11,127	11,146
Tourism, Racing & Fair Trading	1,625	1,628	1,631	1,633	1,636	1,639
NAMING RIGHT ESCALATION		*0.09%*	*0.09%*	*0.09%*	*0.09%*	*0.09%*
	-	-	-	-	-	-
COMMUNICATION ESCALATION		*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
AAPT Limited	368	368	369	369	370	370
Optus Mobile Pty Ltd	750	751	752	753	754	756
PowerTel Limited	368	368	369	369	370	370
Ueaccess Pty Ltd	350	351	351	352	352	353
STORAGE ESCALATION		*0.09%*	*0.09%*	*0.09%*	*0.09%*	*0.09%*
Arts QLD Office	1,742	1,744	1,745	1,747	1,749	1,750
Department of Families- Central Office	1,686	1,687	1,689	1,690	1,692	1,693
DIIESRQ	1,260	1,261	1,262	1,264	1,265	1,266
Families, Aboriginals & TSI, Disabilities	1,452	1,453	1,455	1,456	1,457	1,458
Housing	1,059	1,060	1,060	1,061	1,062	1,063
Pacific Film & Television	152	152	152	152	152	152
State Development	397	397	397	398	398	398
Total	**851,286**	**852,094**	**852,902**	**853,712**	**854,522**	**855,333**

Forecast Income

Tenant		01-Jul-03 31-Jul-03	01-Aug-03 31-Aug-03	01-Sep-03 30-Sep-03	01-Oct-03 31-Oct-03	01-Nov-03 30-Nov-03	01-Dec-03 31-Dec-03
RETAIL							
Hudsons Coffee		5,180	5,180	5,180	5,180	5,180	5,180
0							
0							
0							
0		0	0	0	0	0	0
Retail Rental Income	9	$ 5,180	$ 5,180	$ 5,180	$ 5,180	$ 5,180	$ 5,180
COMMERCIAL							
Arts QLD Office		36,692	36,692	36,692	36,692	36,692	36,692
Department of Families- Central Office		106,978	106,978	106,978	106,978	106,978	106,978
DIIESRQ		164,109	164,109	164,109	164,109	164,109	164,109
Disability Services QLD - Central Office		4,433	4,433	4,433	4,433	4,433	4,433
Families- Corporate Services Centre		53,460	53,460	53,460	53,460	53,460	53,460
Families, Aboriginals & TSI, Disabilities		11,553	11,553	11,553	11,553	11,553	11,553
Heritage Trails Network		4,276	4,276	4,276	4,276	4,276	4,276
Housing		85,254	85,254	85,254	85,254	85,254	85,254
Minister for Innovation & Information Economy		13,338	13,338	13,338	13,338	13,338	13,338
Minister for Tourism, Racing & Fair Trading		12,454	12,454	12,454	12,454	12,454	12,454
Pacific Film & Television		15,432	15,432	15,432	15,432	15,432	15,432
Premier & Cabinet		48,318	48,318	48,318	48,318	48,318	48,318
State Development		187,370	187,370	187,370	187,370	187,370	187,370
Tourism, Racing & Fair Trading		56,134	56,134	56,134	56,134	56,134	56,134
Commercial Rental Income	9	$ 799,800	$ 799,800	$ 799,800	$ 799,800	$ 799,800	$ 799,800
CAR PARKING							
Arts QLD Office		1,950	1,950	1,950	1,950	1,950	1,950
Department of Families- Central Office		5,850	5,850	5,850	5,850	5,850	5,850
DIIESRQ		6,500	6,500	6,500	6,500	6,500	6,500
Families- Corporate Services Centre		975	975	975	975	975	975
Families, Aboriginals & TSI, Disabilities		1,625	1,625	1,625	1,625	1,625	1,625
Minister for Innovation & Information Economy		1,625	1,625	1,625	1,625	1,625	1,625
Minister for Tourism, Racing & Fair Trading		1,625	1,625	1,625	1,625	1,625	1,625
Pacific Film & Television		1,300	1,300	1,300	1,300	1,300	1,300
Premier & Cabinet		2,600	2,600	2,600	2,600	2,600	2,600
State Development		11,050	11,050	11,050	11,050	11,050	11,050
Tourism, Racing & Fair Trading		1,625	1,625	1,625	1,625	1,625	1,625
Car Park Rental Income	9	$ 36,725	$ 36,725	$ 36,725	$ 36,725	$ 36,725	$ 36,725
NAMING RIGHTS							
0		-	-	-	-	-	-
Naming Right Income		$ -	$ -	$ -	$ -	$ -	$ -
COMMUNICATIONS							
AAPT Limited		368	368	369	369	369	369
Optus Mobile Pty Ltd		750	750	750	750	750	750
PowerTel Limited		368	368	368	368	368	368
Ueaccess Pty Ltd		350	350	350	350	350	350
Communication Income	9	$ 1,835	$ 1,835	$ 1,836	$ 1,836	$ 1,836	$ 1,836
STORAGE							
Arts QLD Office		1,742	1,742	1,742	1,742	1,742	1,742
Department of Families- Central Office		1,686	1,686	1,686	1,686	1,686	1,686
DIIESRQ		1,260	1,260	1,260	1,260	1,260	1,260
Families, Aboriginals & TSI, Disabilities		1,452	1,452	1,452	1,452	1,452	1,452
Housing		88	88	88	88	88	88
Pacific Film & Television		152	152	152	152	152	152
State Development		397	397	397	397	397	397
Storage Income	9	$ 6,776	$ 6,776	$ 6,776	$ 6,776	$ 6,776	$ 6,776

Some of the key elements of the schedules are annotated and described as follows:

1	Lessee names sourced from Lease Schedule
2	Rent / fee monthly escalations calculated from the Assumption Sheet
3	First month of forecast market income calculated from the Lease Schedule
4	Forecast market rents for subsequent months calculated using escalations
5	Total potential market rent income calculated by summing the columns
6	Lessee names sourced from Lease Schedule
7	First month of forecast income sourced from Lease Schedule for each tenancy
8	Subsequent monthly income fixed until rent reviews occur
9	Sub-totals of forecast monthly income given per space / use category

Each of the space / use category forecast monthly income sub-totals feed into the Total Capital Discounted Cash Flow Analysis.

5.0 Operating Expense Schedule

The operating expense schedule forms the basis for forecasting the building's operating expenditure for the duration of the cash flow study. Initially, user input is required in terms of entering a single year projection of budgeted operating expenses for the specific building. These projections are usually based on historical expenditure adjusted for anticipated inflation for the subsequent year.

The schedule is broken down into 22 expense category as adopted by the Property Council of Australia and commercial property managers. On user entry of the one year forecast of each operating expense category, the schedule automatically calculates a dollar rate per square metre of lettable floor area based on the total floor area derived from the "Lease Schedule". A comparison of the specific building's operating expense performance compared with industry (Property Council of Australia) benchmarks is automatically generated including a comparative chart. The industry benchmarks are sourced from the "PCA BENCHMKS" sheet which list operating expense benchmarks for buildings of different sizes and grades. The benchmarks shown in the operating expense schedule are automatically selected in accordance with the total area of the building calculated in the "Lease Schedule".

Clicking the "OPEX SCH" tab takes the user to the operating expense schedule and a sample worksheet is shown below:

Operating Expense (OPEX) Schedule — **111 George Street**

5

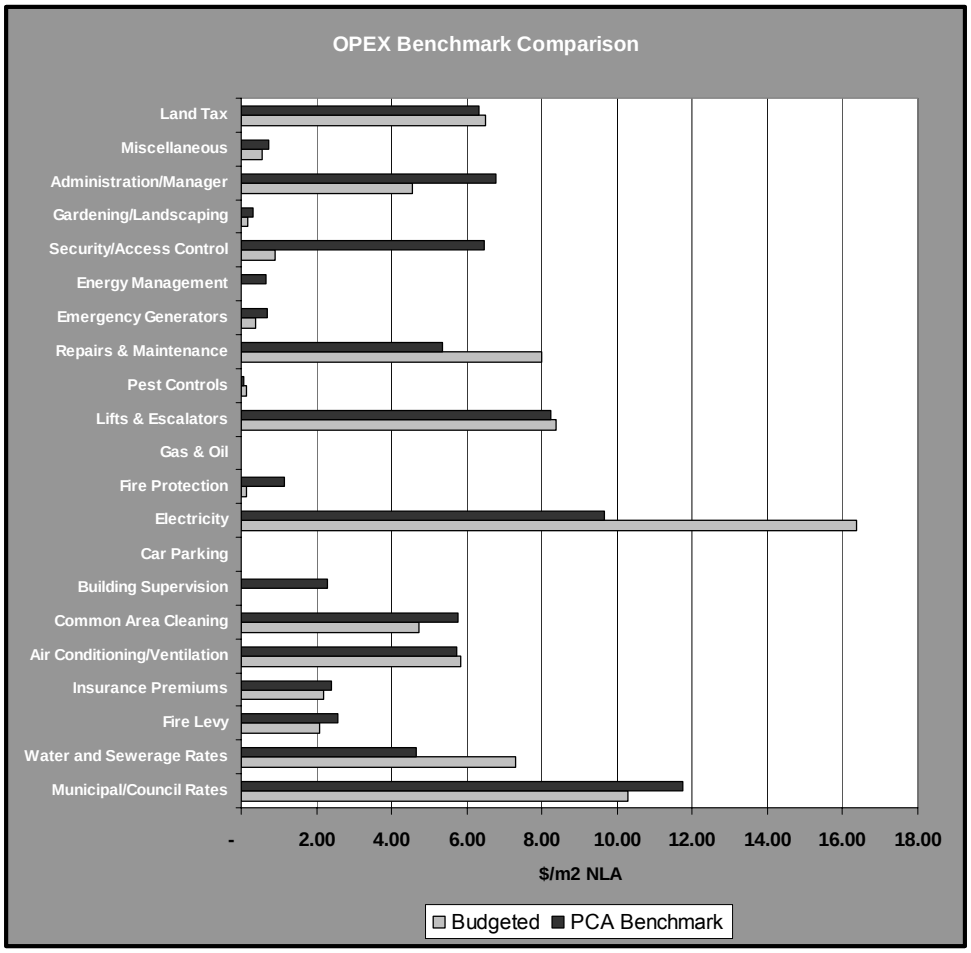
Benchmarking Parameter — Net Lettable Area = 27,467 m²

Forecast Outgoings — *1-Jul-02* to *30-Jun-03*

Annual Operating Expenses		Forecast Expenses	Rate Per Square Metre	PCA Benchmarks Total / Rate Per Square Metre		MOF Forecast Y1	MOF Forecast Post Y1	Notes
STATUTORY CHARGES								
Municipal/Council Rates	$	282,366	10.28	322,468	11.74			Low
Water and Sewerage Rates	$	200,000	7.28	127,998	4.66			High
Fire Levy	$	56,940	2.07	70,866	2.58			
Other Statutory Charges		-	-	-	-			0
Total Statutory Charges	**$**	**539,306**	**$ 19.63**	**$ 521,332.77**	**$ 18.98**			High
OPERATING EXPENSES								
Insurance Premiums	$	60,000	2.18	66,197	2.41			Low
Air Conditioning/Ventilation	$	160,000	5.83	157,389	5.73			High
Common Area Cleaning	$	130,000	4.73	158,487	5.77			Low
Building Supervision		-	-	62,901	2.29			High
Car Parking		-	-	-	-			High
Electricity		450,000	16.38	265,061	9.65			High
Fire Protection		3,500	0.13	31,588	1.15			Low
Gas & Oil		-	-	-	-			High
Lifts & Escalators	$	230,000	8.37	226,057	8.23			High
Pest Controls	$	4,000	0.15	1,923	0.07			High
Repairs & Maintenance	$	220,000	8.01	146,676	5.34			High
Emergency Generators	$	10,100	0.37	19,227	0.70			Low
Energy Management		-	-	18,403	0.67			High
Security/Access Control	$	25,000	0.91	177,440	6.46			Low
Gardening/Landscaping	$	5,000	0.18	8,515	0.31			Low
Administration/Manager	$	125,000	4.55	185,680	6.76			Low
Miscellaneous	$	15,000	0.55	19,777	0.72			Low
Land Tax	$	178,870	6.51	173,594	6.32			High
Other Non Recoverable Expenses								
Statutory Expenses (Exc Land Tax):	$	539,306	19.63	511,873	18.98			High
Operating Expenses:	$	1,427,500	51.97	2,081,473	59.21			Low
Non-Recoverable Outgoings:	$	178,870	6.51	153,452	6.32			High
Total Expenses	**$**	**2,155,776**	**$ 78**	**$ 2,240,248**	**$ 82**			**Low**

1 2 3 4

The associated comparative chart is also shown below:



Some of the key aspects of the operating expense schedule, as annotated, include:

1	Property Council of Australia building operating expense categories
2	User entered projected building operating expenses for the subsequent year
3	Property Council of Australia office building operating expense benchmarks
4	Indicator showing whether specific expense is comparatively high/low
5	Total lettable area sourced from Lease Schedule – determines benchmarks

6.0 Capital Expenditure Schedule

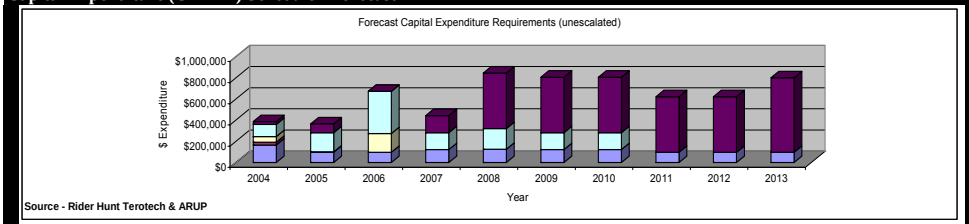
This schedule provides a forecast of the projected capital expenditure required by the specific building over the cash flow study period. The timing of major works expenditure in the cash flow horizon can have a significant impact on the value / return measures derived from the study. Rider Hunt Terotech and ARUP have produced the capital expenditure schedule format contained in the model. The expenditure timings are classified as immediate, short-term and medium-term and expenditure types are categorised as:

- Building Fabric and Finishes;
- Civil, Structural and Façade Engineering;
- Building Code of Australia Compliance;
- Disability Discrimination Act Compliance; and
- Building Services Engineering.

A graphical comparison of relative apportionment of each of these categories for each of projected years in incorporated in the worksheet. This chart alters when the projections are adjusted.

Clicking the "CAPEX SCH" tab at the base of the screen takes the user to capital expenditure worksheet and an example is displayed below:

Capital Expenditure (CAPEX) Schedule - Forecast



Source - Rider Hunt Terotech & ARUP

CALENDAR YEAR		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
BUILDING FABRIC AND FINISHES		$165,000	$98,000	$96,000	$121,000	$126,000	$121,000	$121,000	$96,000	$96,000	$96,000
CIVIL STRUCTURAL AND FAÇADE ENGINEERING		$27,000	$3,000	$0	$0	$0	$0	$0	$0	$0	$0
BUILDING CODE OF AUSTRALIA (BCA) COMPLIANCE		$52,000	$0	$177,000	$0	$0	$0	$0	$0	$0	$0
COMPLIANCE WITH THE DISABILITY DISCRIMINATION ACT		$115,000	$180,000	$400,000	$160,000	$195,000	$160,000	$160,000	$0	$0	$0
BUILDING SERVICES ENGINEERING		$27,500	$85,500	$0	$163,000	$525,000	$525,000	$525,000	$525,000	$525,000	$705,000
TOTAL CAPITAL EXPENDITURE FORECAST		$386,500	$366,500	$673,000	$444,000	$846,000	$806,000	$806,000	$621,000	$621,000	$801,000
Cumulative Capital Expenditure Forecasts		$386,500	$753,000	$1,426,000	$1,870,000	$2,716,000	$3,522,000	$4,328,000	$4,949,000	$5,570,000	$6,371,000
Grouped Expenditure Forecasts		$386,500 Immediate	$1,480,500 Short Term			$4,501,000 Medium Term					

It is recommended that professional advice be sought in assessing the projected capital expense requirements of individual buildings. Firms such as Rider Hunt Terotech and ARUP possess the technical expertise to compile detailed projections. These projections are based on specialist professional knowledge, experience and skills and are formulated after thorough property inspections by appropriate personnel.

The capital expenditure projections feed into the Total Capital Discounted Cash Flow Analysis worksheet and are automatically escalated by the forecast annual inflation rates specified in the Assumption Sheet.

7.0 Letting Up Incentives and Allowances Schedule

As discussed in Section 2.42, letting up costs include the anticipated period (in months) it will take to lease space on it becoming vacant. They also include legal costs associated with producing lease documentation as well as any leasing agents' commissions and marketing costs.

Incentives are inducements provided by landlords to attract new tenants or retain existing tenants to / in a building.

The "Letting Up Incentives and Allowances Schedule" sources parameters for calculating the level of incentives and allowances from the "Assumption Sheet". Rent and timing data is sourced from the income schedule for the calculation of the dollar amounts automatically inserted in the schedule.

The schedule is opened by clicking the "INCENTIVES" tab at the bottom of the Excel screen. A sample extract from the schedule is shown below:

Letting Up Incentives and Allowances

Incentive Including Agents Commission

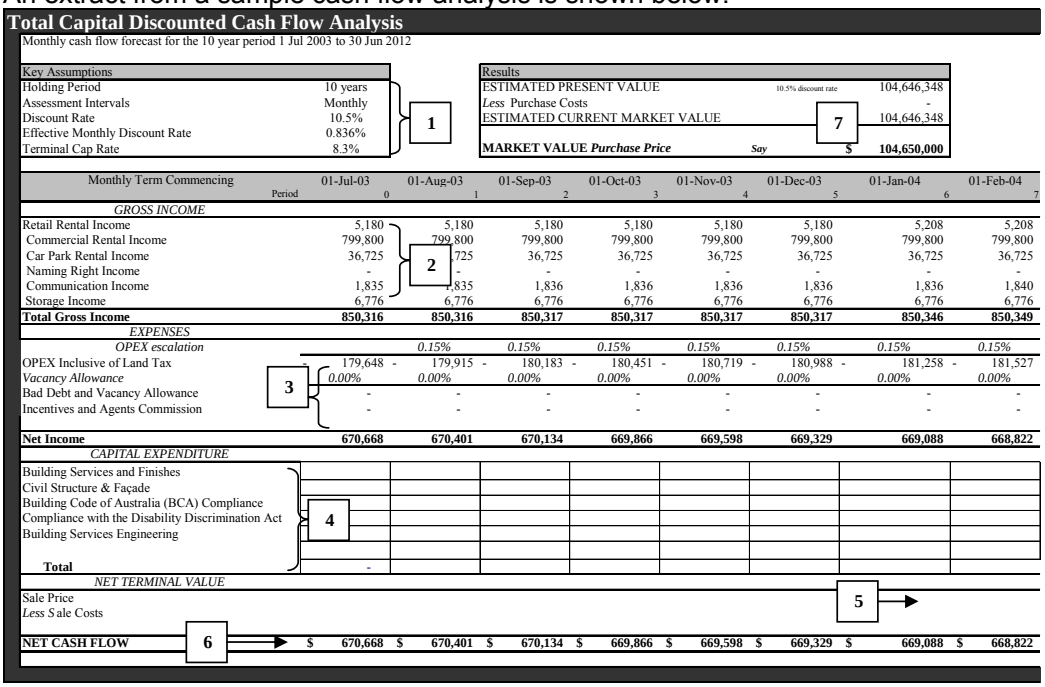
Tenant	01-Jul-03 31-Jul-03	01-Aug-03 31-Aug-03	01-Sep-03 30-Sep-03	01-Oct-03 31-Oct-03	01-Nov-03 30-Nov-03	01-Dec-03 31-Dec-03
RETAIL TENANCIES						
Hudsons Coffee	-	-	-	-	-	-
0	Letting up	Letting up	Letting up	Letting up	Letting up	Letting up
0	Letting up	Letting up	Letting up	Letting up	Letting up	Letting up
0	Letting up	Letting up	Letting up	Letting up	Letting up	Letting up
0	Letting up	Letting up	Letting up	Letting up	Letting up	Letting up
COMMERCIAL TENANCIES						
		-	-	-	-	-
Arts QLD Office	-	-	-	-	-	-
Department of Families- Central Office	-	-	-	-	-	-
DIIESRQ	-	-	-	-	-	-
Disability Services QLD - Central Office	-	-	-	-	-	-
Families- Corporate Services Centre	-	-	-	-	-	-
Families, Aboriginals & TSI, Disabilities	-	-	-	-	-	-
Heritage Trails Network	-	-	-	-	-	-
Housing	-	-	-	-	-	-
Minister for Innovation & Information Economy	-	-	-	-	-	-
Minister for Tourism, Racing & Fair Trading	-	-	-	-	-	-
Pacific Film & Television	-	-	-	-	-	-
Premier & Cabinet	-	-	-	-	-	-
Tourism, Racing & Fair Trading	-	-	-	-	-	-
	Letting up	Letting up	Letting up	Letting up	Letting up	Letting up
AAPT Limited	-	-	-	-	-	-
Optus Mobile Pty Ltd	-	-	-	-	-	-
PowerTel Limited	-	-	-	-	-	-
Ueaccess Pty Ltd						
Total Incentives and Agents Commission	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

The monthly dollar amount for incentives / allowances carries forward as an expense line item in the "Total Capital Discounted Cash Flow Analysis" worksheet.

8.0 Total Capital Discounted Cash Flow Analysis - Monthly

The "Total Capital Discounted Cash Flow Analysis" consolidates the income and expense data sourced from the previous worksheets to generate a summary of monthly cash inflows and outflows for the building. A net cash flow is then derived together with an estimated terminal value for the property at the end of the cash flow study period. An effective monthly discount rate, sourced from the "Assumption Sheet" is used to discount the projected net cash back to a present value.

An extract from a sample cash flow analysis is shown below:



Total Capital Discounted Cash Flow Analysis

Monthly cash flow forecast for the 10 year period 1 Jul 2003 to 30 Jun 2012

Key Assumptions	
Holding Period	10 years
Assessment Intervals	Monthly
Discount Rate	10.5%
Effective Monthly Discount Rate	0.836%
Terminal Cap Rate	8.3%

1

Results		
ESTIMATED PRESENT VALUE	10.5% discount rate	104,646,348
Less Purchase Costs		-
ESTIMATED CURRENT MARKET VALUE		104,646,348
MARKET VALUE *Purchase Price*	***Say***	**$ 104,650,000**

7

Monthly Term Commencing	01-Jul-03	01-Aug-03	01-Sep-03	01-Oct-03	01-Nov-03	01-Dec-03	01-Jan-04	01-Feb-04
Period	0	1	2	3	4	5	6	7
GROSS INCOME								
Retail Rental Income	5,180	5,180	5,180	5,180	5,180	5,180	5,208	5,208
Commercial Rental Income	799,800	799,800	799,800	799,800	799,800	799,800	799,800	799,800
Car Park Rental Income	36,725	36,725	36,725	36,725	36,725	36,725	36,725	36,725
Naming Right Income	-	-	-	-	-	-	-	-
Communication Income	1,835	1,835	1,836	1,836	1,836	1,836	1,836	1,840
Storage Income	6,776	6,776	6,776	6,776	6,776	6,776	6,776	6,776
Total Gross Income	**850,316**	**850,316**	**850,317**	**850,317**	**850,317**	**850,317**	**850,346**	**850,349**
EXPENSES								
OPEX escalation		*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
OPEX Inclusive of Land Tax	- 179,648	- 179,915	- 180,183	- 180,451	- 180,719	- 180,988	- 181,258	- 181,527
Vacancy Allowance	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Bad Debt and Vacancy Allowance	-	-	-	-	-	-	-	-
Incentives and Agents Commission	-	-	-	-	-	-	-	-
Net Income	**670,668**	**670,401**	**670,134**	**669,866**	**669,598**	**669,329**	**669,088**	**668,822**
CAPITAL EXPENDITURE								
Building Services and Finishes								
Civil Structure & Façade								
Building Code of Australia (BCA) Compliance								
Compliance with the Disability Discrimination Act								
Building Services Engineering								
Total	-							
NET TERMINAL VALUE								
Sale Price								
*Less S*ale Costs								
NET CASH FLOW	**$ 670,668**	**$ 670,401**	**$ 670,134**	**$ 669,866**	**$ 669,598**	**$ 669,329**	**$ 669,088**	**$ 668,822**

2

3

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5

6

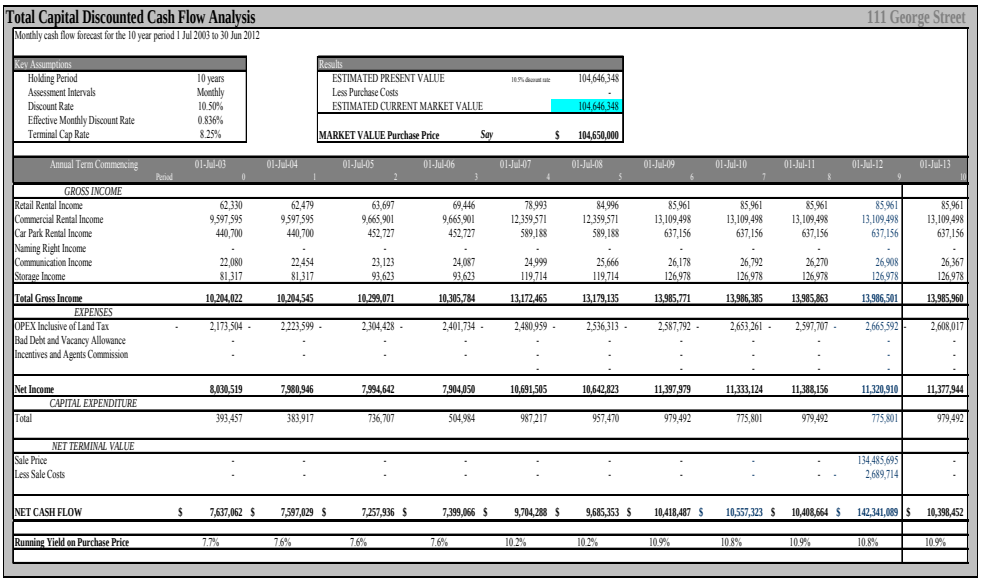
Some of the key elements of the cash flow study are summarised below:

1	Some key assumptions including the selected discount rate and terminal yield
2	Monthly gross income figures for the different space categories
3	Line entries for monthly operating expenses, vacancy allowances and incentives
4	Categorised capital expenditure projections sourced capital expenditure schedule
5	Calculated terminal sale price and selling expenses
6	Building's projected net cash flow including net sale proceeds less selling costs
7	Cash flow analysis output displaying the property's rounded present value

The monthly outputs from this schedule are "rolled up" into annual figures in the "Total Capital Discounted Cash Flow Annual Analysis".

9.0 Total Capital Discounted Cash Flow Analysis – Annual

The annual discounted cash flow study can be viewed by clicking the "ANN TC DCF" tab at the bottom of the screen. This study converts the monthly study to an annual summary by summing the figures in the previous worksheet. It should be noted that the present value calculation still uses the monthly net cash flow figures to derive the value as this approach delivers greater accuracy. An example study is displayed below:



Total Capital Discounted Cash Flow Analysis — 111 George Street

Monthly cash flow forecast for the 10 year period 1 Jul 2003 to 30 Jun 2012

Key Assumptions	
Holding Period	10 years
Assessment Intervals	Monthly
Discount Rate	10.50%
Effective Monthly Discount Rate	0.836%
Terminal Cap Rate	8.25%

Results		
ESTIMATED PRESENT VALUE	10.5% discount rate	104,646,348
Less Purchase Costs		-
ESTIMATED CURRENT MARKET VALUE		104,646,348
MARKET VALUE Purchase Price	**Say**	**$ 104,650,000**

Annual Term Commencing	01-Jul-03	01-Jul-04	01-Jul-05	01-Jul-06	01-Jul-07	01-Jul-08	01-Jul-09	01-Jul-10	01-Jul-11	01-Jul-12	01-Jul-13
Period	0	1	2	3	4	5	6	7	8	9	10
GROSS INCOME											
Retail Rental Income	62,330	62,479	63,697	69,446	78,993	84,996	85,961	85,961	85,961	85,961	85,961
Commercial Rental Income	9,597,595	9,597,595	9,665,901	9,665,901	12,359,571	12,359,571	13,109,498	13,109,498	13,109,498	13,109,498	13,109,498
Car Park Rental Income	440,700	440,700	452,727	452,727	589,188	589,188	637,156	637,156	637,156	637,156	637,156
Naming Right Income	-	-	-	-	-	-	-	-	-	-	-
Communication Income	22,080	22,454	23,123	24,087	24,999	25,666	26,178	26,792	26,270	26,908	26,367
Storage Income	81,317	81,317	93,623	93,623	119,714	119,714	126,978	126,978	126,978	126,978	126,978
Total Gross Income	**10,204,022**	**10,204,545**	**10,299,071**	**10,305,784**	**13,172,465**	**13,179,135**	**13,985,771**	**13,986,385**	**13,985,863**	**13,986,501**	**13,985,960**
EXPENSES											
OPEX Inclusive of Land Tax	- 2,173,504	- 2,223,599	- 2,304,428	- 2,401,734	- 2,480,959	- 2,536,313	- 2,587,792	- 2,653,261	- 2,597,707	- 2,665,592	- 2,608,017
Bad Debt and Vacancy Allowance	-	-	-	-	-	-	-	-	-	-	-
Incentives and Agents Commission	-	-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-
Net Income	**8,030,519**	**7,980,946**	**7,994,642**	**7,904,050**	**10,691,505**	**10,642,823**	**11,397,979**	**11,333,124**	**11,388,156**	**11,320,910**	**11,377,944**
CAPITAL EXPENDITURE											
Total	393,457	383,917	736,707	504,984	987,217	957,470	979,492	775,801	979,492	775,801	979,492
NET TERMINAL VALUE											
Sale Price	-	-	-	-	-	-	-	-	-	134,485,695	-
Less Sale Costs	-	-	-	-	-	-	-	-	-	- 2,689,714	-
NET CASH FLOW	**$ 7,637,062**	**$ 7,597,029**	**$ 7,257,936**	**$ 7,399,066**	**$ 9,704,288**	**$ 9,685,353**	**$ 10,418,487**	**$ 10,557,323**	**$ 10,408,664**	**$ 142,341,089**	**$ 10,398,452**
Running Yield on Purchase Price	7.7%	7.6%	7.6%	7.6%	10.2%	10.2%	10.9%	10.8%	10.9%	10.8%	10.9%

In this study the projected capital expenditure is summed into a single line item. The last line in the study adds a running net yield for each year of the study.

Some of the outputs of this study flow into the charts in the "CHARTS" sheet.

10.0 Operating Expense Benchmarks

The "PCA BENCHMKS" sheet provides a listing of the Property Council of Australia (PCA) operating cost benchmarks derived from a 2002 survey collection of data from 38 buildings in the Brisbane CBD and city fringe. The benchmarks are provided in three building size ranges (<9,000m²; 9,000m² to 18,000m²; and >18,000m²) and two building grade categories (Premium / A-Grade and B-Grade / C-Grade). The building grade categories assigned by the PCA are a representation of building quality levels.

The current listing from the model is shown below:

Property Council of Australia - Office Building Operating Costs Benchmarks - BRISBANE CBD

	Median Cost Summary ($/m² p.a.)					
Cost Item	<9,000m²	9,000 to 18,000m²	>18,000m²	Premium & Grade A	Grade B / C	Near City <9,000m²
STATUTORY CHARGES						
Council Rates	14.88	10.04	11.74	10.53	15.70	5.94
Water & Sewerage Rates	5.59	4.29	4.66	4.74	5.23	6.25
Land Tax	9.32	5.62	6.32	5.97	6.15	2.85
Other Statutory Charges	0.00	3.00	2.58	2.54	6.06	1.67
Total Statutory Charges	31.62	25.56	24.63	25.06	27.98	17.68
Statutory Charges (Excluding Land Tax)	20.47	17.33	18.98	17.81	26.99	13.86
OPERATING EXPENSES						
Insurance Premiums	2.20	1.66	2.41	1.84	2.02	1.10
Air Conditioning / Ventilation	3.51	5.71	5.73	6.01	4.28	3.96
Common Area Cleaning	5.41	7.55	5.77	6.74	5.31	3.75
Building Supervision	0.00	4.66	2.29	2.48	2.78	3.95
Car Parking	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	17.49	12.77	9.65	9.95	12.88	11.28
Fire Protection / Public Address	0.59	1.41	1.15	1.00	1.57	1.10
Gas & Oil	0.00	0.00	0.00	0.00	0.00	0.00
Lifts & Escalators	7.63	5.56	8.23	8.23	5.56	3.22
Pest Control	0.16	0.08	0.07	0.08	0.08	0.08
Repairs & Maintenance	5.83	5.11	5.34	6.87	4.72	4.87
Emergency Generators	0.00	0.35	0.70	0.70	0.20	0.00
Energy Mgmt / Bldg Automation System	0.00	0.00	0.67	0.67	1.73	0.00
Security / Access Control	2.06	1.34	6.46	6.42	1.53	0.92
Gardening / Landscaping	0.43	0.35	0.31	0.35	0.33	1.36
Administration / Management Fee	7.20	6.37	6.76	6.97	6.12	4.84
Miscellaneous	0.00	0.00	0.72	0.72	0.00	0.63
Total Operating Expenses	54.77	51.69	59.21	62.41	49.81	42.97
Total Expenditure	**92.37**	**82.50**	**85.02**	**87.83**	**72.20**	**60.65**

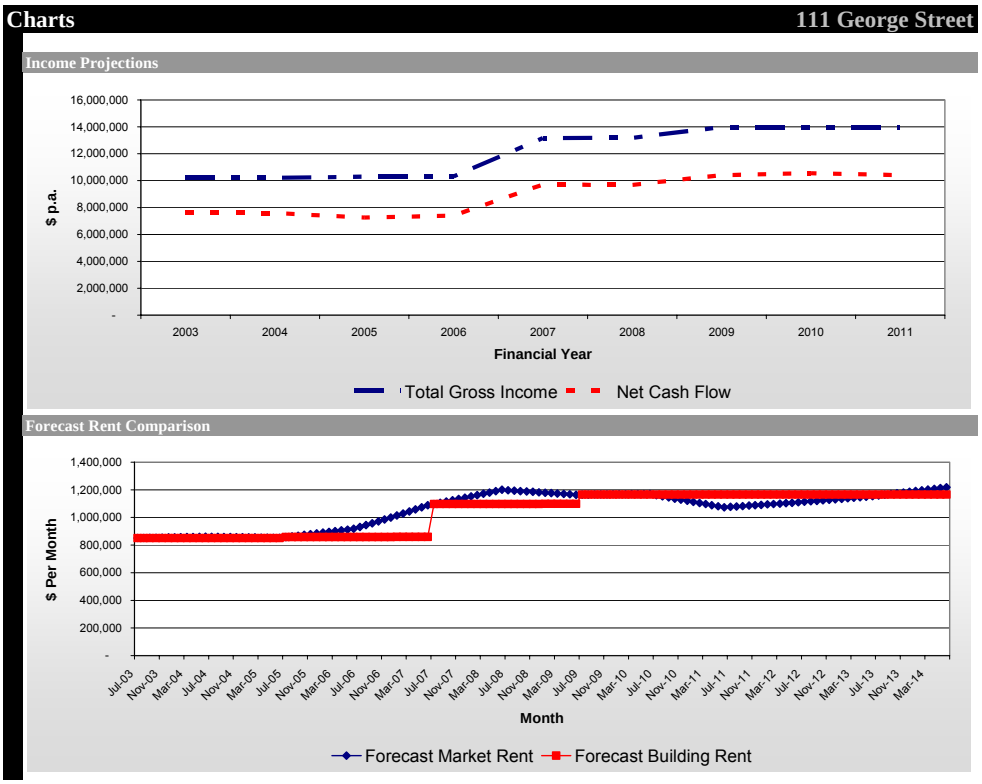
11.0 Model Graphical Outputs

The "CHARTS" worksheet provides some graphical comparisons for the property over the study period, including:

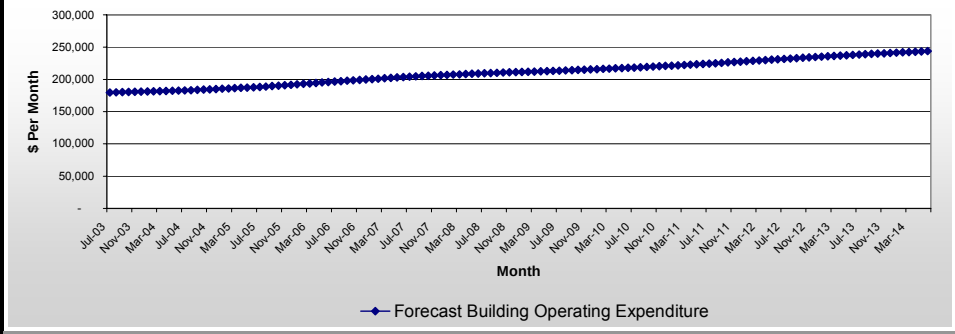
- Projected building gross income and projected building net cash flow;
- Forecast building market rent and forecast building gross rent income;
- Forecast building operating expenditure; and
- Property value sensitivity analysis using discount rate and terminal capitalisation rate as variables.

The charts in this sheet are linked to the cash flow study and will automatically adjust when the existing study is amended or a new study for a different property is established.

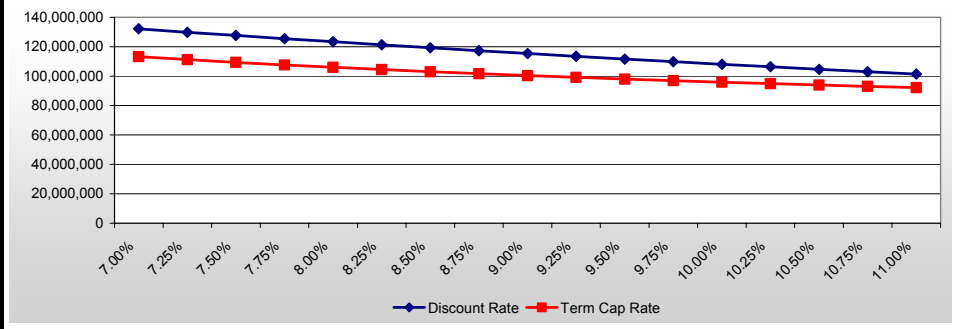
Examples of the charts are shown below:



Forecast Operating Expenditure



Sensitivity Analysis - Discount Rate / Terminal Capitalisation Rate



12.0 Guide to Forecasting and Selection of Key Variables

This section illustrates the components of the model that provides user guidance on forecasting and selecting some of the key property market and economic variables for application in cash flow studies. These processes have been dealt with in detail in *Section 2.0* which covered the development of the key assumptions to be entered in the "Assumption Sheet". Similar information in recorded in separate worksheets within the model and it is proposed to provide a regular updating service to keep the information current. The following sub-sections display the current contents.

12.10 Terminal Capitalisation Rates

Guide to Forecasting and Variable Selection - Terminal Capitalisation Rate

The **terminal capitalisation rate** or **yield** specified in the assumption sheet is a multiplier determining the estimated value of the property at the end of the cash flow horizon. The forecast net cash flow derived from the property during the twelve month period beyond the cash flow horizon is capitalised to estimate this value. The rate is representative of the net return investors would require, at the time, to be enticed to purchase the property. The future value of major capital works anticipated to be required at the terminal date or within two to three years beyond this date should be deducted from the value. Additionally, it may be optimal to apply a **split yield** in circumstances where it is expected wide variations in the risk attaching to two or more income streams flowing from the property would exist.

A 2004 survey of property professionals working in the Brisbane CBD revealed several determinants considered when estimating terminal yields, including:

- Current and historical property yields determined through the analysis of property sales evidence;
- Anticipated tenancy and lease expiry profile at the end of the cash flow horizon (weaker lessee covenants mean higher income risk and higher required returns / yields);
- Assumptions about the required capital expenditure at the end of the study period (eg. whether the building will be in need of refurbishment at the time);
- Existing age and condition of the property and its projected age and condition at the end of the study period; and
- Anticipated class of property and the likely investor type that would be attracted to the property at the time.

Current captalisation rate ranges are often published by the research branches of real estate agencies and valuation firms. As a guide, a study of current Brisbane CBD office building net yields (2003-2004) found prime grade buildings ranging from **7.2%** to **9.0%** while secondary grade buildings ranged from **8.0%** to **10.0%**.

Terminal Capitalisation Rate Assessment: Practical Guide

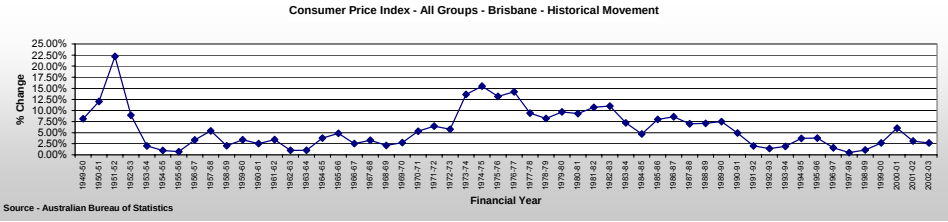
①Examine initial yield from study.
②If the initial yield is not based on a sustainable annual net income, then determine the initial yield on the assumption that the property is fully leased with an allowance for a (small) ongoing vacancy factor.
③Once this initial yield has been established (e.g. 8.5%), then adjust this figure to determine the terminal capitalisation rate as follows:
UPWARD - if the building condition is expected to deteriorate and/or the tenant demand for space is expected to weaken, or if the property market conditions are expected to weaken;
DOWNWARD - if there has been a major renovation of the building or if property market conditions are expected to be stronger than today;
THE SAME - if property is maintained in good condition with some capital expenditure and the market is expected to remain in a similar condition.
④The change from yield to terminal yield will probably not exceed 1% unless severe conditional change is expected.
⑤Once the terminal yield has been determined it should be applied to a sustainable net income for the year ahead (year after the date of sale).
⑥The net income for the year after the date of sale should be adjusted only if there are major vacancies or expected capital expenditure in that year. If these factors occur adjust the net income to a sustainable net income (similar to the process in point 2).

12.20 Inflation

Guide to Forecasting and Variable Selection - Inflation

Inflation forecasts specified in the assumption sheet are used to escalate the building's future operating and capital expenditure over the cash flow study period. A 2004 survey of Brisbane CBD valuers found an almost universal reliance on inflation forecasts sourced from external economists. Two prominent Australian firms noted for publishing inflation forecasts include Access Economics and BIS Shrapnel. Several property researchers have recommended using a forecast average where multiple forecasts are available.

The long term average inflation rate for Brisbane since 1949 has been approximately **5.8%**. However, recent inflation trends and forecasts have been at lower levels and less volatile. The chart, below, tracks the Brisbane inflation rate since 1949.



Average consumer price index forecasts indicate an average change of **2.8%** to **3.2%** over the next three years.

12.30 Discount Rates

Guide to Forecasting and Variable Selection - Discount Rates

The **discount rate** specified in the assumption sheet is used to discount the property's future net cash flows, including proceeds from the terminal sale, back to a present value. Discount rates are market driven, being explicit measures of investor required total returns from real estate and other assets. A 2004 survey of Brisbane CBD property professionals revealed several considerations are incorporated in the assessment of discount rates, including:

- cash flow analysis of recent investment property sales evidence to derive comparable discount rates;
- communication with institutional property investors to establish their accepted investment return parameters;
- current level of the long-term bond rate, being a proxy for the risk free investment rate, and the likely risk premium rate acceptable to property investors;
- quality of property being assessed, including standard, location, condition and lease / lessee profiles; and
- competitive returns available from alternative investments, including shares and other property assets.

Specific property discount rates are rarely published. The dominant assessors of office building discount rates are valuers and their presentation of these rates is mainly limited to valuation reports for clients. The survey noted that different valuers may use different assumptions in their analyses of rates of return for sales of investment properties. This process derives inconsistencies in analysed rates for specific properties among different firms.

As a guide, recent (2004) valuer analysed Brisbane CBD office building sales evidence has derived total rates of return in a relatively narrow band from **10%** to **12%**.

Discount Rate Assessment - Practical Guide

The suggested steps involved in assessing an appropriate discount rate include:

①Study the calculated or expected yield and terminal yield for the property. The discount rate represents a return on income and capital, thus the discount rate should be greater than the initial yield by approximately the capital appreciation expected from the property.

②However, always remember that the market sets the discount rate as it is the expected total return required by investors. Thus the best assessment of the discount rate is from market evidence. Attempt to get the investor's expectation of return if your study is for a specific investor.

③If the study relates to the market (instead of a study for a specific client), market evidence must be used in establishing the discount rate. There is a sophisticated risk/return approach outlined below, but this can only be used when substantial sales evidence is available.

④The discount rate should be checked against financial benchmarks. The benchmark calculation is the risk-free rate plus risk factors for both the property sector and the subject property. As a guideline only you can take the current risk-free rate (a good proxy is the ten-year bond rate) add 2% to 3% for the property sector risk and add a further 0% to 4% for the individual property risk. Note that the property risk does not include the rent risk incorporated in the income schedule. This is not an accurate approach and can arrive at a wide range of returns, but it is a useful check exercise.

Risk-Return Profile to Assess the Discount Rate

The risk-return approach is explained in greater detail in Boyd (1993) and the process may be summarised as:

①Undertake a forecast DCF exercise for several comparable sales using the sale price and expected income flow over a five to ten year period.

②Calculate the IRR for the comparable sales and also calculate the standard deviation of the anticipated net income for the period of the study.

③Determine the coefficient of variation (standard deviation divided by IRR) for each sales property and plot these figures on a risk/return diagram.

④Calculate the best fit from the plots on the risk return diagram.

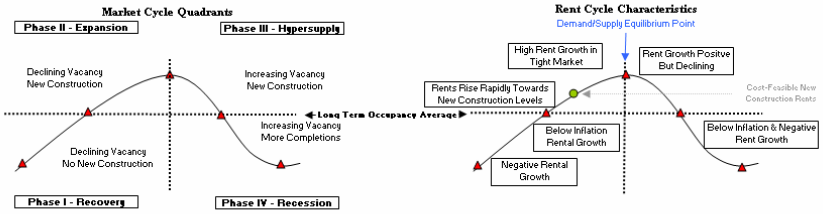
⑤Assess the expected net income flow from the subject property over the same time period as the sales and calculate the standard deviation of the net income - this is the risk measure for the subject property

12.40 Market Rents

Guide to Forecasting and Variable Selection - Market Rents

The **market rent** escalation rates contained in the assumption sheet stipulate the future changes in rent levels applied in the cash flow model. Forecasts are predominantly generated by modelling property market and economic leading indicators' influences on office rents. An extensive review of international office rent modelling studies has found researchers have adopted the level of vacancy, space supply and observed rent levels as the principal market determinants of future rents. The dominant economic determinants adopted have been white collar employment, economic activity and interest rates.

The current position of the market in the property cycle will influence the determination of the rental growth rates. The following diagrams, sourced from American research by Mueller (1995), illustrate an interpretation of the four property market cycle quadrants and how these can be characterised in terms of office rent growth rates.

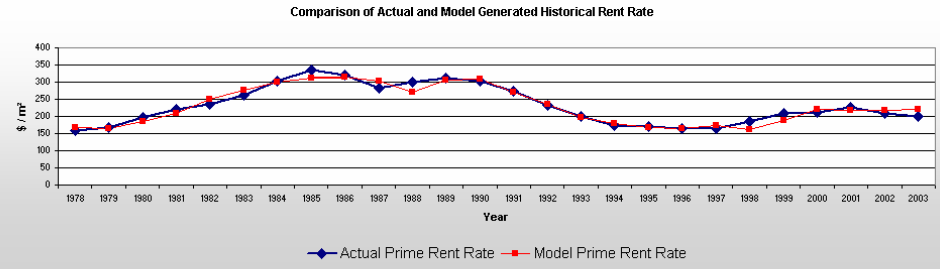


A number of firms, including Jones Lang LaSalle, BIS Shrapnel and LandMark White, give guidance on the market's position in the cycle and produce office market forecasts for sale to clients. Models from such sources are rarely published for commercial reasons. Tests of a number of published models using Brisbane CBD historical data produced unsatisfactory results. Independent research aimed at estimating a suitable model for the Brisbane CBD derived the following equation:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \beta_2 V_{t-2} + \beta_3 SU_{t-2} + \beta_4 AB_t + \beta_5 I_t + \varepsilon$$

Where:
R = observed prime gross effective office rent rate adjusted for inflation
V = vacancy rate as a percentage of total stock (lagged two years)
SU = new office supply as a percentage of total stock (lagged two years)
AB = net office space absorption in square metres
I = Commonwealth ten-year bond rate as an annual average

Statistical results indicate observed rent, lagged vacancy rate and net space absorption are particularly influential in driving the level of Brisbane office rents. This meaning reducing vacancy levels and increasing space absorption by tenants signal potential rent increases. The historical fit of the equation (with an adjusted coefficient of determination of 0.93) is strong, as demonstrated in the chart below:



A version of this model is incorporated in the rent model sheet and this requires user inputs to operate. However, property researchers have emphasized the importance of not simply relying on the output of mathematical models when generating market forecasts. There needs to be an additional qualitative input by property professionals to ensure forecasts are plausible. In addition, models need to be frequently updated and recalibrated to remain viable. As a forecast guide, the 2004 survey of Brisbane CBD valuers generated the following mean forecast for CBD prime, gross rent rates:

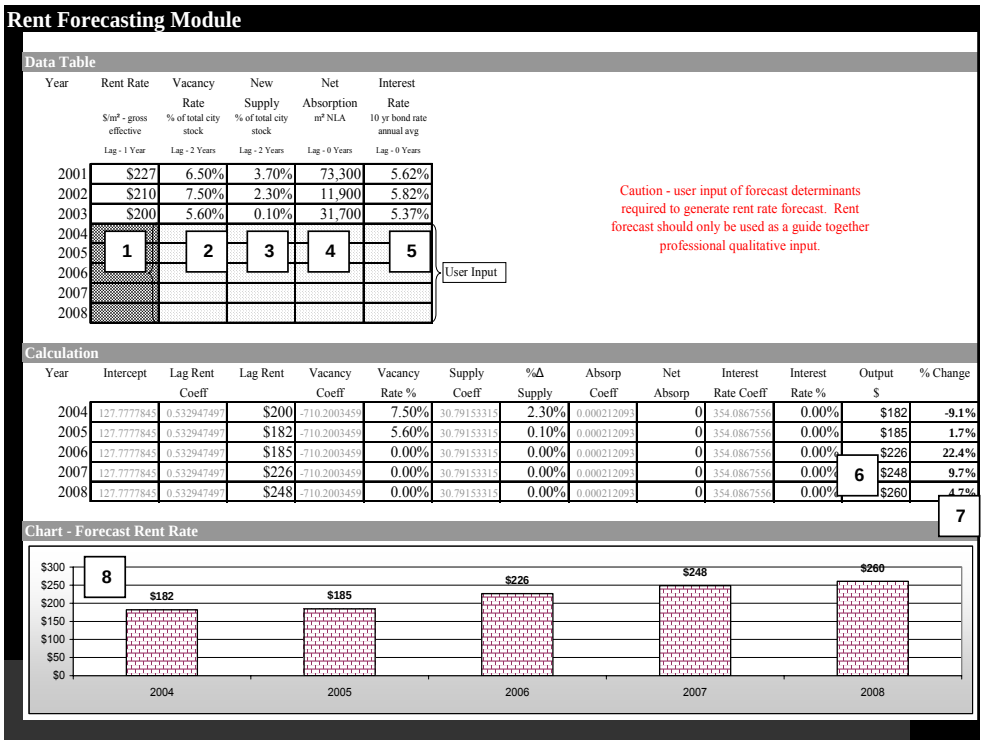
2004 - +2.2%
2005 - +3.0%
2006 - +4.6%
2007 - +4.7%
2008 - +3.4%

Market Rent Forecasts - Practical Guide

① Substantial research shows that both macroeconomic factors and the property's characteristics will influence rent growth.
② It is important to understand the current position in the property cycle and the state of the national and local economy. Trends in population growth (especially employment in the specific sectors), gross state (or national) product and interest rates should be studied and taken into account.
③ The property characteristics, in the particular the tenant demand for the particular space, will also strongly influence the growth rate of the rental income.
④ There is no simple formula to assess future rental growth, but the formula in the rental growth model above is a good approach using probable determinants of rental growth.
⑤ If it is not possible to use the rental growth model due to a lack of available data, you should assess the annual growth rate according to expected property market cycle changes and the condition of the property.
⑥ It is not recommended that you use a single average growth rate for the period of the study. This does not take account of the cyclical nature of property supply and demand.

13.0 MARKET RENT FORECASTING MODULE

Analysis of the historical dynamics of the Brisbane CBD office market led to the estimation of the rent equation detailed in the previous section. This equation has been simulated with the inclusion of calculated coefficients in the "Market Rent Forecasting Module" worksheet. The object of this module is to provide a guide to office rent forecasts based on the input of lagged and forecast explanatory variables by the user. Note that forecasts generated by the module should only be used as a guide together with qualitative input from property professionals. The module is illustrated below with some descriptive annotations.



Rent Forecasting Module

Data Table

Year	Rent Rate $/m² - gross effective Lag - 1 Year	Vacancy Rate % of total city stock Lag - 2 Years	New Supply % of total city stock Lag - 2 Years	Net Absorption m² NLA Lag - 0 Years	Interest Rate 10 yr bond rate annual avg Lag - 0 Years
2001	$227	6.50%	3.70%	73,300	5.62%
2002	$210	7.50%	2.30%	11,900	5.82%
2003	$200	5.60%	0.10%	31,700	5.37%
2004					
2005	1	2	3	4	5
2006					
2007					
2008					

User Input

Caution - user input of forecast determinants required to generate rent rate forecast. Rent forecast should only be used as a guide together professional qualitative input.

Calculation

Year	Intercept	Lag Rent Coeff	Lag Rent	Vacancy Coeff	Vacancy Rate %	Supply Coeff	%Δ Supply	Absorp Coeff	Net Absorp	Interest Rate Coeff	Interest Rate %	Output $	% Change
2004	127.7777845	0.532947497	$200	-710.2003459	7.50%	30.79153315	2.30%	0.000212093	0	354.0867556	0.00%	$182	-9.1%
2005	127.7777845	0.532947497	$182	-710.2003459	5.60%	30.79153315	0.10%	0.000212093	0	354.0867556	0.00%	$185	1.7%
2006	127.7777845	0.532947497	$185	-710.2003459	0.00%	30.79153315	0.00%	0.000212093	0	354.0867556	0.00%	$226	22.4%
2007	127.7777845	0.532947497	$226	-710.2003459	0.00%	30.79153315	0.00%	0.000212093	0	354.0867556	0.00%	6 $248	9.7%
2008	127.7777845	0.532947497	$248	-710.2003459	0.00%	30.79153315	0.00%	0.000212093	0	354.0867556	0.00%	$260	4.7%

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Chart - Forecast Rent Rate

1	Median prime gross effective rent rate for the previous year
2	CBD percentage vacancy rate two years previously
3	New office space supply as a percentage of total stock two years previously
4	Forecast net office space absorption for the current year in square metres
5	Forecast average ten year bond rate current year
6	Forecast rent rate output from model based on user input
7	Forecast percentage change in rent rate based on user input
8	Graphical output displaying rent forecast

14.0 ENVIRONMENTAL BENCHMARKS

An extensive literature study has derived a qualitative guide to appropriate environmental benchmarks for office buildings. This guide is contained in the "ENVIROBENMKS" worksheet and is displayed below:

Environmental Benchmarks - Office Buildings

① Resource Consumption

Net fossil fuel energy use, on an intra-building (sub-metering) and market comparison basis. Efforts to reduce greenhouse gas emissions, particularly from energy use. Office lighting power density and peak energy demand reduction strategies. Evidence of alternative energy supplies from renewable sources or from cogeneration.

Age and condition of air-conditioning plant and the desirable use of ODP or GWP refrigerants.

Water consumption from potable, hygiene and cooling tower uses, recycling and water capture measures, and wastewater reduction of flow to sewer. Evidence of hazardous and non-hazardous waste and effluents recycling or removal strategies.

② Design

Location from centres, public transport availability and standard of service, together with a suite of strategies to discourage single occupancy vehicle journeys, including cyclist facilities.

Age of building in terms of obsolescence or depreciation of materials detracting from environmental appeal, re-use or upgrade history or potential, suitability of original materials for refurbishment and façade retention, and the ecological impacts of materials used (can be obtained by using LCA Design or similar software package

Indoor quality measured by ventilation, natural lighting, views, individual thermal control, noise abatement and the absence of indoor air pollutants.

Quality of overall built environment and site use in relation to aesthetics and visual blending, the building's celebration, utilisation, connection, contribution and appropriation of its street frontage and wider precinct.

③ Governance

The maximisation by management of the potential of the environmental design features by conducting awareness programs.

Disclosure / transparency of environmental data, non-compliance with regulations, awards and environmental expenditure of any type.

Building's net contribution to green space with some consideration to prior land use.

15.0 SOCIAL BENCHMARKS

An extensive literature study has derived a qualitative guide to appropriate social benchmarks for office buildings. This guide is contained in the "SOCIALBENMKS" worksheet and is displayed below:

Social Benchmarks - Office Buildings

① Health and Safety

- compliance with H&S regulations and appropriate signage
- adequate public liability and service provider insurance
- awareness and training of emergency evacuation and accident first aid procedures for all floor wardens
- a first aid station accessible to all building users

② Stakeholder Relations

- monitoring of stakeholder concerns, views and provisions
- transparency and disclosure of landlord / tenant contracts and marketing agreements
- supportive use and occupation guidelines for tenants
- appropriate training for security and public relations personnel

③ Community Engagement

- encouragement of employment of local residents in building
- provision of accessible public facilities (seating, toilets)
- promotion of and linkage to local service providers
- accessible communication channels with building stakeholders

④ Accessibility

- connections to designated green spaces
- proximity to urban spaces (town and local centres, malls, etc)
- availability and efficeincy of public transport
- wheelchair access and proximity to childminding facilities

⑤ Occupier Satisfaction and Productivity

- quality of communal service areas e.g. toilets, kitchen facilities
- complementary usage of building (comparable tenants)
- occupant productivity in terms of satisfaction and physical wellbeing
- smart technology design provisions

⑥ Cultural Issues

- recognition of indigenous people through allocation of cultural space for display or performance, including the communication of site, building or community history
- consideration of gender equity and minority group requirements
- preservation of heritage values
- value of artwork as a percentage of fitout (5% considered acceptable)

⑦ Local Impacts

- aesthetic implications (compliance with precinct theme, building scale, etc.)
- practical implications (traffic generation, off-street emergency parking and pedestrian management)
- nature of tenant businesses and naming rights
- community linkages and sponsorship of local neighbourhood activities

7.4 Appendix III - BUILDING AUDIT REPORTS

The industry partners ARUP and Rider Hunt Terotech undertook extensive audits on the case study buildings, which are appended to this report.

7.5 Appendix IV - AUXILLARY REPORTS

Three reports have been selected to append to this report. Dr David Parker was commissioned to produce a report surveying the use of various cash flow models in industry. The other two reports were written by the research team and will be presented at the CRC for Construction Innovations International Conference to be held at the Gold Coast in October 2004.

8. AUTHOR BIOGRAPHIES

Principal author

Professor Terry Boyd.

Contributing authors

Mervyn Cowley was released from the full-time employ of the Queensland Department of Public Works (QDPW) to undertake a Masters by Research at QUT.

Marcello Tonelli has transferred from Research Associate on this project at QUT to also commence a Masters degree.

Philip Kimmet was engaged as a full-time researcher for the last 12 months of the project. Mr Kimmet is a PhD candidate in the School of International Business at Griffith University, he holds an Honours degree in Environmental Science, and has a background as a property valuer in the public and private sectors. Mr Kimmet has published in the *International Journal of Development Issues* and has presented a number of refereed conference papers both in Australia and overseas.